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THE DISTRIBUTION OF INCOME AND TAXES/TRANSFERS IN CANADA: A COHORT ANALYSIS[†]

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SUMMARY

Who pays and how much? These are crucial questions for any tax system and, given the complexity of the economy, they are also among the most difficult to answer. This paper undertakes an analysis of the distribution of taxes and transfers in Canada using a static approach based on annual income combined with the novel approach of breaking down taxpayers by age cohort. The paper examines how tax rates net of transfers differ by age and income group, and how those rates change over taxpayers' lifetimes. It clearly reveals the progressive nature of Canada's tax system. In our base case scenario, when all age cohorts are considered together and transfers are treated as negative taxes, the first two quintiles of the income distribution are net recipients of government transfers with negative net tax rates equal to about -48 percent for the first quintile and -33 percent for the second quintile. For middle to high-income individuals net tax rates are positive and increase with income, from 10 percent for the median group, to 24 percent for the fourth quintile and 34 percent for the fifth quintile. Looking at net tax rates by age cohort, we find that overall the bottom 20 percent of the income distribution is a net recipient of fiscal transfers at all ages. However, on average for individuals 65 and over all but the top 20 percent of the income distribution are net recipients of fiscal transfers, with negative net tax rates. The age related redistributive nature of Canada's tax system is further emphasized by an examination of the Gini coefficients for each age cohort, calculated here for the first time. Starting at age 30, before taxes and transfers income inequality is found to rise monotonically with age, leveling off at 65. Taxes and transfers reduce the degree of income inequality significantly for all ages, but substantially more so for the elderly due to age related features of the tax and transfer system. If redistribution can be thought of as a one of the fundamental features of the tax and transfer system in Canada, the extent to which it is targeted at the elderly is an important secondary feature.

[†] We wish to thank Frances Woolley and participants at The School of Public Policy Symposium on "Income Inequality and Taxation: A Reality Check" for their comments that improved this paper. We also wish to thank the referees and especially Bev Dahlby, the editor, for their helpful comments.

A portion of this analysis is based on Statistics Canada's Social Policy Simulation Database and Model (SPSD/M). The authors prepared the assumptions and calculations underlying the simulation results and the responsibility for the use and interpretation of these data is their own.

I. INTRODUCTION

The purpose of this paper is to study the distribution of income and the incidence of taxes and transfers in Canada. To conduct the analysis, various assumptions are used to estimate average tax rates on different income groups, taking into account almost all forms of taxes and transfers at the federal and provincial level. No matter which scenario is adopted, the overwhelming conclusion is that Canada's tax and transfer system is quite progressive. Average tax rates double from 17 to 35 percent as income rises from the lowest to highest categories, when taxes are calculated as a share of income including government transfers. If transfers are viewed as negative taxes, the average tax rate rises from -48 percent to 34 percent from lowest to highest income groups. Over age cohorts, we find that Canada's tax/transfer system substantially reduces income inequality with the greatest impact on retired seniors.

There are several aspects of this study that are unique compared to previous tax incidence studies in Canada.

Although we undertake a fairly standard static or annual tax incidence analysis, rather than adopting a lifetime approach, we parse the data by age cohort. This is in contrast to most static studies of tax incidence, which group all cohorts together.¹ This cohort approach allows us to consider the distribution of the burden of the tax/transfer system both within and across age groups.

Another unique aspect of the study is the manner in which we incorporate various shifting assumptions regarding the incidence of taxes and transfers. Particularly important here is our treatment of corporate income taxes, the burden of which is presumed to fall primarily on labour in our base case scenario. This is based upon evidence discussed below suggesting that much of the burden of the corporate income tax is transmitted to wage earners via lower wages, rather than to investors by way of a reduction in investment income.

We also employ what we think is an innovative approach with regard to the treatment of the contributions and benefits associated with the Canada and Québec Pension Plan (CPP/QPP). We treat the CPP/QPP system as a hybrid tax/transfer and pure savings system. Using actuarial analysis, which calculates the effective internal rate of return on CPP/QPP contributions by year of birth, we determine for each age cohort the portion of CPP/QPP contributions that can be thought of as a tax versus saving, and the portion of benefits that can be viewed as a transfer versus a return to savings. This approach highlights the importance of undertaking a cohort analysis.

Finally, we conclude the paper with a discussion of income inequality within and across age cohorts. We calculate pre- and post-fisc Gini coefficients (a measure of the degree of income inequality) for each age cohort. This allows us to examine the manner in which income inequality varies across ages, and to determine the extent to which the tax and transfer system redistributes toward various age groups. We find that a substantial amount of income is redistributed to the elderly in Canada.

¹ An exception is a recent paper examining fiscal incidence in New Zealand: Omar Aziz, Norman Gemmell and Athene Laws, "The Distribution of Income and Fiscal Incidence by Age and Gender: Some Evidence from New Zealand," *Working Papers in Public Finance* 10 (2013): Victoria Business School, Victoria University of Wellington.

II. ASSESSING TAX INCIDENCE

Tax incidence asks the seemingly simple question: who bears the burden of taxes in society? Indeed, the distribution of the burden of taxation is one of the most fundamental issues of tax policy, most particularly in the public arena — most of the public discussion of tax policy concerns the distribution of taxes. It is perhaps trite to point out that politicians and the public agree that everyone should pay their “fair share” of taxes. However, it turns out that this is a very complicated and contentious issue, for two reasons. First, the very notion of fairness is a value judgment that varies across individuals and there is no reason to think that all citizens have a common view as to what is meant by fair taxation. For example, individuals might agree that those with similar circumstances and income should bear a similar tax burden (often referred to as horizontal equity). Moreover, many would also agree that those who are better off should pay more taxes since they have greater capacity to cover the cost of public services (referred to as vertical equity). In other words, the tax burden should rise with income. But then the questions arise: How much more? Proportionally more? Progressively more?

Second, as is usual with most metrics, calculating the average tax burden for different income classes presents a host of theoretical and practical issues for analysis. It turns out that tax incidence is not a simple concept to measure. And in fact taxpayers who appear at first glance to bear the burden (incidence) of a tax may not bear the ultimate burden.

For the purposes of this paper, we will define a tax system to be progressive (regressive) if the average tax rate rises (falls) with income levels. There are other potential definitions of progressivity (such as rising marginal tax rates with income), but the conventional approach is to look at tax burdens in terms of average rates.

A critical question in any incidence study involves the determination of what fiscal policies to include in the analysis. Governments levy taxes to cover the cost of public services and to transfer income among households. Should tax incidence focus on taxes alone, ignoring transfers? Should income measures include transfers from governments? Or should transfers be viewed as negative taxes and therefore not included in income? The answers to these questions depend on whether one is interested in tax incidence for one part of the fiscal system, or the fiscal system as a whole, including government transfers.

One approach is to assess only tax burdens as tax payments relative to income that could either include transfers (broad income measure) or not (narrow income measure). Past tax incidence studies² have often used the broad income measure, which involves adding government transfers to income since many transfers themselves are taxable. Tax incidence then focuses on actual taxes paid relative to the broad income received by individuals or households. This approach makes the tax system appear more progressive since transfers tend to provide greater support to lower income groups and therefore result in lower tax rates measured for low-income households. A narrow measure would tend to increase the measured tax rate at the low-income level.

In our view, however, it is appropriate to think of the redistributive impact of the overall fiscal system in Canada. From this perspective, transfers should be viewed as negative taxes and excluded from measured income. Further justification for this perspective lies in the fact that in the Canadian tax system, transfers and refundable tax credits have been used interchangeably. For example, child tax benefits have at different times taken the form of grants paid to households or refundable tax credits.

² See, for example, Frank Vermaeten, W. Irwin Gillespie and Arndt Vermaeten, “Tax Incidence in Canada,” *Canadian Tax Journal* 42, no.2 (1994): 348-416, which provides a good survey of literature as well as a detailed analysis of tax incidence.

Another example is the refundable GST credit, which was instituted for the purpose of making the federal consumption tax progressive, not as a demogrant paid to low-income households.³

To understand who bears the burden of taxation, it is critical to understand who ultimately pays the tax, which may differ from who bears the legal liability for the tax. While the legal liability is often clear, it turns out to be less informative, and even irrelevant, as to who bears the ultimate economic burden. This is due to the impact that taxes have on prices, wages, rates of return, etc., in the economy.

For example, the corporate income tax is legally payable by corporations. But corporations sell their goods and services to consumers, employ workers and pay a return on capital to owners — thus the common saying: “corporations don’t pay tax, people do.” And indeed, the burden of the corporate income tax may be distributed to some combination of consumers through higher prices, workers through lower wage rates, or shareholders through lower returns on their investment in the firm.⁴ Similarly, while workers are legally responsible for paying personal income tax, it is possible through wage negotiations that some of the tax could be shifted forward onto the employer as higher wages paid, which therefore must be recovered through higher consumer prices that affect the purchasing power of household income.⁵

There are several choices to be made in how tax incidence is modeled. The first concerns the use of a partial vs. a general equilibrium approach. General equilibrium models are large, complicated models of the economy which explicitly link the various sectors and allow prices, wages, rates of return, etc., to respond to changes in the tax and transfer system. Partial equilibrium analysis, on the other hand, is somewhat easier as it does not explicitly model the connections between the various markets and sectors. Our approach is to use insights from the general equilibrium literature to inform our choice of various shifting assumptions that underlie the analysis that is effectively a partial equilibrium approach.

Another issue is whether tax incidence should be based on individual or family income. Family income best reflects the economic income that households have to cover expenditure needs and things like shared housing costs. Further, households have different living arrangements — some are single individuals, others have two earners and no dependents and others consist of families. Moreover, in principle it would be appropriate to measure not only market income but also the non-market income realized by households due to home production (and leisure).⁶ While all of this is important, our age cohort approach necessitates the use of individual income.

Studies also differ in whether they examine annual tax incidence — a static, one-year snapshot of households — or lifetime incidence, which accounts for taxes paid by households over time. Most analysts would agree that the lifetime approach to tax incidence analysis is, in principle, superior. There are three main reasons for this conclusion.

First, when looking at a snapshot of the economy for one year, young and retired individuals typically have less income than during the rest of their lifetime; indeed, our analysis shows this starkly. Therefore, the amount of tax paid by young workers and retirees would be less than that paid during the rest of

³ Piketty and Saez also argue in favour of treating transfers as negative taxes. See Thomas Piketty and Emmanuel Saez, “How Progressive is the U.S. Federal Tax System?: A Historical and International Perspective,” *Journal of Economic Perspectives* 21, no.1 (2007): 8-9.

⁴ We discuss the incidence of the corporate income tax in more detail below.

⁵ Douglas A. L. Auld and David A. Wilton, “The Impact of Progressive Income Tax Rates on Canadian Negotiated Wage Rates,” *Canadian Journal of Economics* 21, no.2 (1988): 279-284.

⁶ An attempt at measuring the value of home production in income tax incidence across household is in Matt Krzepkowski and Jack Mintz, “How Income Splitting Can Bring Fairness to Canada’s Single-Income Families,” *The School of Public Policy Research Series* 6, no.15 (2013). Based on Statistics Canada studies, it is estimated that the 2011 average value of unpaid work of a stay-at-home spouse without children is \$25,836, a premium over an employed spouse of \$11,012.

their lifetime, especially if the tax system is highly progressive with much higher tax burdens on those with higher incomes. Looking at a snapshot of incomes to assess tax burdens under the annual incidence approach is sensitive to the proportion of young and old to middle income workers and the growth in earnings.

Second, annual incidence studies fail to properly assess tax burdens on savings and the return to investments, often leading to an underestimate of the progressivity of a tax system. For example, when the government imposes sales and excise taxes, annual incidence studies suggest that the consumption taxes paid in a year are typically regressive, since higher income households tend to save more than low-income households. Yet savings that are stored for future consumption purposes will be subject to future sales tax. Indeed, assuming that the return on savings is equal to the opportunity cost of investing capital in alternative assets (i.e., there are zero economic rents)⁷ and taking into account the time value of money, the purchase of future consumption goods is equal to current savings. Thus, savings are subject to the same sales tax burden as current consumption. Under annual incidence studies, regressive taxation under sales taxation is overestimated since future taxes on savings used for consumption are ignored.⁸ Under lifetime incidence, the future sales taxes would be incorporated in a full analysis of tax incidence.

Thirdly, income in a given year may be subject to significant fluctuations in response to business cycles, both at the higher end and the lower end of the income distribution (bonuses, layoffs, etc.). As a result, annual incidence may result in unusually high or low measures of taxes, depending upon the particular year chosen for reference, and income taxes appearing more progressive than they would be based on lifetime or permanent income measures.

While we think that on theoretical grounds the lifetime approach is superior to use for assessing tax incidence and the progressivity of the tax system, the lifetime incidence approach requires longitudinal data or some approach whereby incomes and consumption can be estimated over time. Unfortunately, we do not yet have access to the appropriate data that allow us to undertake such a study. Therefore, we opt to undertake a static analysis based on annual income, with the innovation that we investigate incidence by age cohort. We recognize that the use of the annual incidence approach tends to bias results, showing less progressivity in the tax system since savings, exempt from consumption taxes, are more significant with upper-income groups. However, measuring tax rates for various age cohorts allows us to assess not only how tax rates differ by age and income groups today, but how one's tax rates may evolve over a lifetime if the tax system does not change significantly compared to the reference point in 2008.⁹

⁷ People who save may intend to leave a bequest to children. Bequests consumed by children would be subject to sales taxes as well. It might be argued that bequests themselves should be taxed separately from the consumption of heirs since wealth transferred to children is a form of consumption. Therefore, sales taxes may be somewhat regressive since bequests are not subject to consumption taxes.

⁸ Edgar K. Browning and William R. Johnson originally made this point in *The Distribution of the Tax Burden*, American Enterprise Institute, Washington D.C. 1979.

⁹ Annual data can be used to simulate lifetime income profiles and infer lifetime incidence if assumptions are been made regarding earnings mobility over a lifetime. In James Davies, France St-Hilaire and John Whalley, "Some Calculations of Lifetime Tax Incidence," *The American Economic Review* 74, no.4 (1984): 633-649, annual data are used to construct synthetic longitudinal lifetime income profiles in order to compare lifetime and annual tax incidence. Rather than following the same approach to simulate lifetime incidence results, we opt for a simpler annual incidence study where we report average tax rates for each age cohort separately.

III. OUR APPROACH

As discussed above, all tax incidence studies involve a number of modeling trade-offs and a myriad of assumptions. We discuss our assumptions here.

As discussed, we employ a static microsimulation partial equilibrium approach and make various shifting assumptions based on the insights from general equilibrium models. In particular, we use the Statistics Canada SPSP/M (Social Policy Simulation Database/Model) program.

The SPSP/M consists of a static microsimulation model (SPSM) and a synthetic database (SPSD). The database is created by combining data from the Survey of Labour and Income Dynamics (SLID) with administrative data from personal income tax returns, Employment Insurance histories from an administrative dataset and household expenditure patterns from the Survey of Household Spending. A key element of SPSP/M is the inclusion of commodity and sales taxes. In this regard, the SPSP/M employs an input-output model, COMTAX, which produces effective tax rates for 10 commodity taxes for each of the 48 personal expenditure categories. The COMTAX model assumes that firms pass their sales tax burden forward to the final consumer (and indeed this is the base shifting assumption we employ). As such, commodity taxes include both direct taxes (taxes paid by the final consumer) as well as indirect taxes (taxes from the intermediate stages of production and passed on to the final consumer which are included in the price of a good). COMTAX models consumption taxes for the statistical taxpayers, which mimic the profiles of actual consumers and taxpayers according to other data collected by Statistics Canada.

The strength of the SPSP/M is the very high level of detail it employs in representing Canada's tax and transfer system. However, there are two problems with using the model for incidence analysis. The first is that it reflects a number of naïve shifting assumptions, based on statutory rather than economic incidence, which are at odds with the economic literature on tax incidence. This requires us to make various adjustments to the data, which we describe in detail below.

The second problem with the SPSP/M is that it is a static, annual model; it represents a snapshot of the earnings, transfers and taxes of taxpayers at a particular point in time. As discussed above, we think that a lifetime approach is ultimately better to understand the redistributive role of the tax and transfer system when data are available. Instead, we make the best use of annual data by examining the distribution of income and taxes within and across age cohorts in Canada. This involves using the SPSP/M to undertake a standard static or annual tax incidence study with the innovation that the data are parsed by age cohorts. As indicated above, most static studies of tax incidence group all cohorts together.

The static age cohort approach allows us to analyze how tax rates vary not only across income groups in general, but income groups within each age cohort, as well across ages for a particular income group. The downside is that, even though we agree that household income and taxes offer a more complete picture of actual tax burdens, we can only talk about age cohorts in a meaningful way by focusing on individual, as opposed to family, income. We restrict our analysis to individuals 20 years and older, with total income for tax purposes above zero in 2008.

Our starting point focuses on four income variables reported by SPSPD/M. We retrieve each of these values by age cohorts: 20-24, 25-29, etc., and within each cohort by income group, where individuals are split based on their *total income* into five quintiles (denoted QU1 to QU5). The four income variables are:

- Market Income (MI) = total income from market activities (including employment and self-employment income, investment income, private pension income, etc., but excluding CPP/QPP income);
- Total Income (TI) = market income plus transfer income (including CPP/QPP income and employment insurance benefits);
- Disposable Income (DI) = total income minus total personal taxes except federal and provincial commodity taxes;
- Consumable Income (CI)¹⁰ = disposable income minus commodity and sales taxes.

Table 1 below shows the four income thresholds (corresponding to the 20th, 40th, 60th and 80th percentiles) that define our income groups, for each age cohort and for the population in general, as well as the number of SPSPD records in each age group.

TABLE 1 TOTAL INCOME THRESHOLDS BY AGE COHORT (2008 \$)

Age	Records	P20	P40	P60	P80
20-24	13,606	6,932	11,897	18,075	29,153
25-29	10,404	14,387	25,871	37,643	51,067
30-34	11,649	18,544	31,674	45,031	61,923
35-39	15,773	17,448	32,557	47,796	70,568
40-44	19,009	18,606	33,745	49,285	72,486
45-49	20,194	18,382	34,400	49,476	74,585
50-54	21,695	17,296	32,454	48,424	76,222
55-59	15,563	12,735	26,434	42,390	67,325
60-64	10,603	10,349	20,899	35,484	54,353
65-69	6,610	15,484	20,885	32,238	50,324
70-74	4,184	14,519	18,982	26,913	41,810
75+	8,561	16,731	19,955	25,980	39,177
All ages	157,851	14,468	24,717	38,916	60,279

The four income definitions produced by the SPSPD/M are based on various implicit tax shifting assumptions, some of which can be considered simplistic for reasons that are explained shortly.

First, as mentioned above, under the COMTAX model embedded in SPSPD/M, it is assumed that firms fully pass forward sales taxes (commodity taxes and general sales taxes such as the GST/HST and provincial sales taxes) to the final consumer of the product. Thus, taxpayers bear the entire burden of

¹⁰ Disposable and Consumable Income are easy to confuse. Disposable Income is Total Income (including transfers) minus all taxes except consumption taxes, while Consumable Income is Total Income minus total taxes, including consumption taxes. The difference between Disposable and Consumable Income is therefore consumption taxes. Consumable Income is not the same as consumption, but represents the income available to either consume or save, after all taxes have been paid.

sales and excise taxes in proportion to their consumption. This is relatively non-controversial, and we maintain this shifting assumption.¹¹

Second, the SPSD/M assumes that payroll and income taxes levied on employees are completely borne by labour, while payroll taxes levied on employers are borne by the business. Moreover, with regard to payroll taxes, Employment Insurance (EI) and CPP/QPP premiums are treated as taxes, while the resulting benefits are treated as transfers. Similarly, workers compensation and provincial health premiums are borne by labour. As discussed below, we make significantly different assumptions regarding the burden of payroll taxes and benefits in our analysis.

Third, corporate income taxes are ignored altogether in SPSD/M; we incorporate corporate income taxes in a manner described shortly.

The differences between these income measures allow us to calculate several transfer and tax measures. For each group, we calculate the taxes paid and transfers received by the *average person* in each age-income group. In particular:

- Transfers = Total Income minus Market Income;

This measure reflects all transfers received by individuals at the federal and provincial level (Old Age Security (OAS) payments, Guaranteed Income Supplement (GIS) benefits, spouses allowance, Child Tax Benefit, EI benefits, provincial family programs and social assistance, GIS top-ups, provincial tax credits, and others) including a share of their CPP/QPP income, as explained below.

- Personal Income, Payroll, and Other (PPO) Taxes (excluding consumption taxes) = Total Income minus Disposable Income;

This measure reflects all taxes paid by individuals to provincial and federal governments, directly or indirectly, with the exception of commodity and sales taxes. They include explicit taxes like personal income and payroll taxes, including CPP/QPP contributions, EI contributions, Workers' Compensation, but also provincial health premiums, other taxes like Quebec's parental insurance plan premium for paid workers and for self-employed, etc. We add to these the corporate income taxes and the employer share of payroll taxes, which are implicitly paid by labour and/or capital owners through lower wages and returns to capital (details on how this is done are given below).

- Consumption Taxes = Disposable Income minus Consumable Income;

This measure is generated by the commodity tax model (COMTAX) built in SPSD/M and accounts for eleven different commodity and sales taxes at the federal and provincial levels, including GST, HST, federal import duties, provincial profits on liquor commissions, federal fuel taxes, provincial fuel taxes, provincial sales taxes, etc.

Income Adjustments

As discussed above, the representation of income and taxes in the SPSD/M implicitly reflects what may be viewed as rather naïve shifting assumptions. To incorporate what we view as more reasonable assumptions as suggested by the literature, we operate some adjustments to the basic income measures

¹¹ Some studies have suggested that roughly 90 percent of sales taxes on business inputs are shifted forward to consumers rather than shifted back to producers. See Michael Smart, "The Impact of Sales Tax Reform on Ontario Consumers: A First Look at the Evidence," *The School of Public Policy Research Papers* 4, no.3 (2011) updated August 2012 and Jonathan Kesselman, "Consumer Impacts of BC's Harmonized Sales Tax: Tax Grab or Pass-Through?" *Canadian Public Policy* 37, no.2 (2011): 139-162.

from the SPSPD/M. These adjustments primarily concern corporate income taxes and the treatment of CPP/QPP payments and benefits.

By way of summary, in our basic scenario we recalculate Market, Total, Disposable and Consumable Income based on the following assumptions (more detailed discussion is provided below):

- Since Canada is a relatively small open economy with mobile capital with some home-bias regarding equity investments, we assume that corporate income taxes are shifted to a large extent onto the less mobile factor — labour. Specifically, in our base case we assume that 30 percent of corporate income taxes paid by large corporations are borne by the owners of capital, by way of lower investment income, and 70 percent by labour through lower market wages. For small privately held corporations, we assume that the owners bear the entire burden of the corporate income tax. Since SPSPD/M reports income net of the corporate income tax implicitly paid by labour and capital owners, we adjust it by adding corporate income taxes back to market and total income in proportion to labour earnings and investment income;
- In Canada both employers and employees pay payroll taxes like EI and CPP/QPP contributions, but SPSPD/M only models the employee share. Since aggregate labour supply is relatively inelastic, it is reasonable to assume that employers are able to shift their share of payroll taxes onto employees in the form of lower wages. Thus, employer payroll taxes are an implicit tax on labour income, which again we add back to each individual's total and market income.
- SPSPD/M treats CPP/QPP contributions as a pure tax and benefits as a pure transfer. Reality is more complex, as we think that it is more reasonable to treat CPP/QPP as a hybrid tax/transfer system and as a substitute for personal savings. Moreover, the extent to which this is the case varies by age cohort. Based on actuarial data we undertake age-specific adjustments to CPP/QPP contributions and benefits to reflect what we think are reasonable assumptions in this regard.

We elaborate on these assumptions in what follows.

Corporate Income Taxes

The burden of corporate income taxes has historically been one of the most contentious issues in public finance. In his pioneering general equilibrium model, Arnold Harberger¹² showed that, depending upon the assumptions made about the nature of production and consumption, the corporate income tax, which is legally paid by corporations, could be borne by some or all of: owners of capital through lower rates of return on their investments, labour through lower wages, or consumers through higher prices charged on products and services. In Harberger's original model, capital (and savings) is fixed in supply and the economy is closed to international capital flows — i.e., the stock of domestic savings equals the stock of domestic capital. Harberger showed that under what he considered the most reasonable set of assumptions —in particular that the corporate tax in the capital-intensive industries was differentially higher than in labour-intensive industries— capital owners fully bear the burden of corporate taxes by way of a lower after-tax return to capital.

However, many have subsequently questioned this conclusion (including Harberger himself), and argued that part, and perhaps most, of the corporate income tax could fall on labour through a reduction in wages. Several arguments have been made in this vein. First, if total capital is not fixed in supply and depends on the amount of savings available to fund it, a lower rate of return on capital could cause investors to reduce savings by consuming more current goods and services. Second, corporate tax regimes could impose higher taxes on labour-intensive industries, especially if governments provide fast

¹² Arnold C. Harberger, "The Incidence of the Corporate Income Tax," *Journal of Political Economy* 70, no.3 (1962): 215-240.

write-offs for capital expenditures under the corporate income tax. Even though labour is substituted for capital in production, the labour-intensive products are more costly to produce, leading to a shift of demand toward capital-intensive products. Again, the corporate tax may therefore be partially borne by labour through lower wages.

Finally, and perhaps most importantly, Harberger's original model was set in a closed economy, with no trade and no international capital flows. Things change markedly in an open economy setting where capital owners can shift their investments abroad if the rate of return on capital falls below the international rate of return on capital. For a small open economy, the shift of savings from a small country to world markets will not affect the rate of return on capital. Therefore, the corporate tax cannot be borne by capital owners who receive the same after-tax rate of return on capital no matter what the level of corporate tax. Instead, immobile factors of production in a small open economy, such as labour, must bear the corporate income tax.

Indeed, Harberger himself illustrated this result in a follow-up to his original paper.¹³ For example, he shows in a simulation model that in an open economy labour bears almost 96 percent of the burden of CIT. In a similar vein, Randolph shows that labour bears 70 percent of CIT with fixed world capital stock.¹⁴

Of course, the world is much more complicated than suggested by simulation models. Some studies have shown that investors have a "home bias" to invest in domestic securities resulting from institutional or informational barriers to trade.¹⁵ If this is the case, corporate taxes could be borne in greater part by capital owners. Certainly, smaller corporations have little or no access to international markets, so that home bias is most important in these cases. This can be important because in Canada, Canadian-controlled private corporations that claim the small business deduction earn roughly a third of corporate taxable income.¹⁶

As the above discussion shows, the incidence of the corporate income tax is a very complex issue, and can vary dramatically depending upon the underlying assumptions of the model. A key issue is the extent to which labour bears the burden of the corporate tax through lower wages. More recently, researchers have eschewed complicated general equilibrium calculations in favour of empirical studies that investigate the link between corporate taxes and wages directly. The results of four recent studies in this vein are summarized here:

- Arulampalam et al. (2012, p.1049): "a \$1 increase in the tax liability leads to a 64 cents reduction in total compensation in the short run, and a 49 cents reduction in the long run."¹⁷
- Felix (2009, p. 90): "In the case of the state corporate income tax, labor bears a significant burden from the tax in the form of lower wages. Regression analysis shows that a one-percentage-point increase in the marginal state corporate tax rate reduces wages 0.14 to 0.36 percent. Labor's burden

¹³ Arnold C. Harberger, "Corporate Tax Incidence: Reflections on what is Known, Unknown, and Unknowable," in *Fundamental Tax Reform: Issues, Choices and Implications*, ed. John W. Diamond and George R. Zodrow. (Cambridge: MIT Press, (2006).

¹⁴ William G. Randolph, "International Burdens of the Corporate Income Tax," *Congressional Budget Office Working Paper* no.9 (2006).

¹⁵ See, for example, Piet Sercu and Rosanne Vanpée, "Home Bias in International Portfolios: A Review," Katholieke Universiteit Leuven, Department of Accountancy, *Finance and Insurance Research Report* AFI 0710 (2007). Canada's share of world equity capital markets in 2005 is 3.5 percent but Canadian holdings of domestic equity securities are 76.6 percent, suggesting significant home bias in equity markets. Netherlands displays the least home bias with only 32.1 percent of domestic equity securities held by the Dutch.

¹⁶ Data provided by the Department of Finance.

¹⁷ Wiji Arulampalam, Michael P. Devereux and Giorgia Maffini, "The Direct Incidence of Corporate Income Tax on Wages," *European Economic Review* 56, no.6 (2012): 1038-1054.

from the state corporate tax has trended upward over time. In the 1990s and early 2000s, wages began falling more in response to higher corporate tax rates than in the late 1970s and 1980s.”¹⁸

- Hassett and Mathur (2006, p. 25): “The results in this paper suggest that corporate tax rates affect wage levels across countries. Higher corporate taxes lead to lower wages. A 1 percent *increase* in corporate tax rates is associated with nearly a 1 percent *drop* in wage rates.”¹⁹
- Liu and Altshuler (2013, abstract): “Over all industries, our estimates suggest that a \$1.00 increase in corporate tax revenue decreases wages by approximately \$0.60.”²⁰

While some have questioned the magnitude of these estimated effects,²¹ in our view a reasonable interpretation of the research is that there is an emerging consensus that labour bears a significant share of the corporate income tax (CIT) by way of lower wages. In our base case calculations we therefore assume that 70 percent of the burden of corporate income taxes falls on labour and 30 percent on capital. As discussed below, we also consider an alternative scenario where the entire burden falls on capital. Importantly, our approach also distinguishes between large and small corporations. As indicated above, since small businesses have less access to international capital markets compared to large businesses, we think it is more reasonable to assume that the owners of small businesses bear more of the burden of the corporate tax compared to the owners of large businesses. Since in our dataset self-employment income is included in labour income, by treating differently the effect of corporate taxes on labour and capital income we implicitly treat differently small and large businesses, with a greater share of corporate taxes borne by small business owners than large business owners in our preferred scenario.

CPP/QPP Contributions and Benefits

Some taxes, particularly payroll taxes, are contributions to government-operated social security programs such as the CPP/QPP, EI and provincial workers’ compensation programs. These taxes typically entail a maximum annual contribution that is binding for higher income individuals. This means that treating payroll contributions as pure taxes without adjusting for program benefits will tend to overstate the regressivity of payroll taxes. Our approach is to treat CPP/QPP payroll contributions as a combination of savings and taxes, with the ratio between the tax/transfer and saving components changing by age cohort, depending on the implied rate of return on the CPP/QPP contributions.

A key issue that motivates our treatment of CPP/QPP contributions and benefits concerns the extent to which public pension plans are a substitute for private savings. From a macroeconomic perspective this is a very important issue, especially for pay-as-you-go plans, as it concerns how public pensions affect aggregate savings. With pay-as-you-go public pensions, any reduction in private savings in response to public pensions will decrease aggregate savings in the economy. From the microeconomic perspective of this study, the key issue is whether the contributions of those currently working to CPP/QPP should be viewed as taxes or as a substitute for savings, and in turn whether the benefits received by current retirees should be viewed as transfers or as the return to savings. This has a significant impact on how taxes and transfers are represented.

¹⁸ R. Alison Felix, “Do State Corporate Income Taxes Reduce Wages?,” *Federal Reserve Bank of Kansas City Review, Second Quarter* (2009).

¹⁹ Kevin A. Hassett and Aparna Mathur, “Taxes and Wages,” *American Enterprise Institute for Public Policy Research Working Paper* no.128 (2006).

²⁰ Li Liu and Rosanne Altshuler, “Measuring The Burden Of The Corporate Income Tax Under Imperfect Competition,” *National Tax Journal*, National Tax Association, 66, no.1 (2013): 215-37.

²¹ See, for example, Jennifer C. Gravelle, “Corporate Tax Incidence: A Review of Empirical Estimates and Analysis,” *Congressional Budget Office Working Paper* 2011-01 (2011).

Most early public pension plans, including Canada's, were initially based on the pay-as-you-go principle. Under this approach there is no explicit connection between the benefits received on retirement and the amount contributed — current benefits are paid for out of current contributions (i.e., current workers pay the benefits of retirees). Even in this case, however, standard life-cycle models of consumer savings suggest that public pensions crowd out, or displace, private savings, since one the main reason people save is to provide for themselves after retirement.

Martin Feldstein's pioneering study of the US social security system in the 1970s was among the first empirical studies of the issue.²² He found that social security in the US had a large and statistically significant impact on private savings, although the displacement was less than one to one. This suggests that households treat public pensions as at least a partial substitute for savings. However, his results have been questioned in numerous subsequent studies. A somewhat dated review of the evidence suggests that public pensions reduce private savings by between zero and 50 cents per dollar.²³

The CPP is currently neither a pay-as-you-go nor a fully funded plan. Reforms in 1997 introduced partial funding with the goal of restoring the financial sustainability of the plan, which was previously run on a pay-as-you-go basis.²⁴ Since the reform, the plan can be characterized as a hybrid between a pay-as-you-go system and a fully funded system, referred to as "steady-state funding," whereby the contribution rate is set at the lowest level that is sufficient to ensure the long-term stability of the plan without further rate increases.

The implication of this is that on a present value basis current recipients of CPP income, as well as some soon-to-retire participants, receive more from the pension plan than they would have if they had simply saved their contributions, while younger cohorts will receive less. Indeed, the CPP actuarial report for 2009 indicates that the real rate of return on CPP assets varies significantly by age cohort. While the long-term rate of return for all contributors is 4.0 percent,²⁵ it declines from 6.3 percent for those born in 1940 to only 2.3 percent for those born in 2000.²⁶ As the report puts it, "the differences provide an indication of the degree of intergenerational transfer present in the Plan."

We take what we think is a novel approach to dealing with CPP/QPP contributions and benefits, treating them in part as taxes and transfers and in part as savings and return to savings, depending upon the

²² Martin Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation," *Journal of Political Economy* 82, no.5 (1974): 905-926; Martin S. Feldstein and Anthony J. Peltzman, "Social Security and Household Wealth Accumulation: New Microeconomic Evidence," *Review of Economics and Statistics* 61, no.3 (1979): 361-368.

²³ See for example, "Social Security and Private Savings: A Review of the Evidence," Congressional Budget Office, Washington D.C., July 1998.

²⁴ Office of the Superintendent of Financial Institutions Canada Report, "Intergenerational Balance of the Canadian Retirement Income System," by Chief Actuary Jean-Claude Ménard and Actuary Assia Billig prepared for the International Social Security Association Technical Seminar on Proactive and Preventive Approaches in Social Security-Supporting Sustainability, Muscat, Oman 23-24 February 2013 available at <http://www.osfi-bsif.gc.ca/Eng/oca-bac/sp-ds/Pages/jem20130224.aspx>

²⁵ Office of the Superintendent of Financial Institutions Canada, "Actuarial report 25th on the Canada Pension Plan as at 31 December 2009," 3 November 2010, p. 22.

²⁶ *Ibid.*, p.74.

age cohort.²⁷ In our calculations, we assume that the average individual contributes to CPP/QPP for 40 years and benefits for 20 years, and the benchmark real rate of return on retirement savings is four percent. By comparing the benchmark rate of return with the actual age-specific rate of return on CPP contributions, we estimate the degree to which current CPP/QPP contributions by younger cohorts can be viewed as a tax (benefiting older cohorts) versus saving for one's own retirement. Similarly, we estimate the proportion in which current CPP/QPP income can be viewed as a transfer versus return to past contributions/savings. Our estimates are summarized in the table below.

TABLE 2 ESTIMATED TAX AND TRANSFER COMPONENTS OF CPP/QPP BY AGE COHORT

Birth Year	Actual IRR	Transfer component of CPP/QPP Income	Tax component of CPP/QPP Contributions
1940	6.3%	53.4%	0%
1950	4.2%	6.4%	0%
1960	3.0%	0%	27.8%
1970	2.4%	0%	40.5%
1980	2.3%	0%	42.3%
1990	2.2%	0%	44.1%
2000	2.3%	0%	42.3%

Source: Authors' calculation.

We apply these percentages to split the current CPP/QPP contributions for each age cohort into a tax component and a saving component, and we include the latter in their disposable and consumable income. For the older cohorts, we treat part of their CPP/QPP income as transfer and part as return to savings or earned pension income, and we include the earned portion in their market income.

As a general rule, the tax component of the CPP/QPP contributions decreases with age, and the transfer component of the CPP/QPP contributions increases with age, as older cohorts benefit more from the system than younger ones. However, two groups of individuals in our dataset do not fit in this pattern and are treated differently:

- Some people receive CPP/QPP benefits before the standard retirement age of 60-65, mostly in the form of disability benefits, survivor's pension and children's benefits. The rules to qualify for these benefits and the amounts paid by the system are not exclusively related to past CPP/QPP contributions, thus for simplicity we treat all CPP/QPP benefits received by individuals younger than 60 as transfers.
- On the other hand, we have people who continue to work and contribute toward CPP/QPP after the standard retirement age of 65. For this group we assume that their current CPP/QPP contributions partly offset their smaller past contributions, and it is unlikely that their overall contribution to CPP/QPP exceeds the benefits the plan will provide (as it does for the younger cohorts.) Since these people

²⁷ Unlike CPP, the Québec Pension Plan was from its inception based on a partly funded approach — a combination between pay-as-you-go and fully funding. According to the “Actuarial report of the Quebec Pension Plan as at 31 December 2009,” the contribution rate has been raised several times due to economic and demographic pressures, but the plan is still not fully funded. A reform in 1998 resulting in an abrupt increase in the contribution rate from 6.0 percent in 1997 to 9.9 percent in 2003 was intended to ensure long-term funding, as well as “fairness between generations of contributors.” This implies that current contributors to the plan have to contribute more compared to previous generations to enjoy similar benefits, which justifies a similar treatment for QPP as we undertake for CPP. Current QPP contributions are in part a tax that supports older generations, and current QPP benefits are in part a transfer from the younger to the older contributors. For lack of specific data regarding the rate of return of the Québec Pension Plan by age cohort, we use the same rates derived from the CPP actuarial report to break down the QPP contributions and benefits into a tax/transfer and a saving component.

will be the sole beneficiaries of their current CPP/QPP contributions, we treat their current CPP/QPP contributions entirely as saving and include them in their disposable and consumable income.

With these assumptions, we add the current CPP/QPP contributions and income of each age cohort to the appropriate income categories, based on the rates outlined in Table 3 below. When we look at all ages together, the share of CPP/QPP income that should be treated as return to savings or market income and the share of current contributions that should be treated as saving are calculated as a weighted average across all age cohorts, using as weights the total CPP/QPP income and CPP/QPP contribution, respectively, of each age cohort.

TABLE 3 ESTIMATED SAVING COMPONENT OF CURRENT CPP/QPP CONTRIBUTIONS AND INCOME BY AGE COHORT

Age Cohort	Current CPP/QPP Contributions Representing Saving for Retirement (added to Disposable and Consumable Income)	Current CPP/QPP Income Representing Return to Savings (added to Market Income)
20-24	57.7%	0.0%
25-29	57.7%	0.0%
30-34	59.5%	0.0%
35-39	59.5%	0.0%
40-44	72.2%	0.0%
45-49	72.2%	0.0%
50-54	100.0%	0.0%
55-59	100.0%	0.0%
60-64	100.0%	46.6%
65-69	100.0%	46.6%
70-74	100.0%	46.6%
75+	100.0%	46.6%
All ages	74.4%	42.3%

Source: Authors' calculation.

Employment Insurance Contributions/Income

An argument could be made that the EI program is like any other insurance program: people contribute to EI to insure against the risk of losing their job, and the EI income represents the payout from this insurance. However, several features of the EI program in Canada contradict this argument. While it is a government-provided insurance program against unemployment, the EI program is not actuarially fair. Individuals in high-unemployment regions qualify more easily for EI, and also benefit from it for longer periods of time than those in low-unemployment regions. Moreover, there is no employer experience rating of EI contribution rates, whereby firms pay higher premiums if they tend to lay off workers more than others (such experience rating is used in the United States). Thus, the EI program has an important redistribution component, and we therefore treat EI contributions (employer and employee) as payroll taxes and EI benefits as transfers from government.

One element that is missing from our analysis is property taxes. One reason for excluding them is our choice to work with individual-level data, while property taxes are incurred at household level. Theoretically household taxes could be imputed to the individual members of the household on the basis of consumption of household services, however this is difficult to measure. Moreover, the economic incidence of property taxes is not entirely settled in the literature. Some argue that property taxes are a benefit tax that falls on a property's consumption of municipal services, and therefore regressive, while

others believe that the property tax is a tax on capital, unrelated to the amount of municipal services consumed, and progressive like other capital taxes.²⁸ A related issue involves the inclusion of implicit rental income from owner-occupied housing income. Again, we have chosen not to include this due to measurement issues.

A cursory investigation of the implications of omitting property taxes from the analysis suggests that little would change. Property tax rates calculated as a ratio to total income range from 0.4 percent to 5.5 percent, generally increasing with age for all income groups and decreasing with income within each cohort, with an average for all taxpayers of 1.5 percent. However, the measure of income used in this calculation does not include implicit income from owner-occupied housing, which would tend to lower the ratios, especially for older cohorts who are more likely to own their houses. As such, we do not think that adding property taxes to the mix will alter the overall picture, and total tax rates would remain generally progressive for all ages with some exceptions for the first quintile. Within each income group, for all except the first quintile, total tax rates including property taxes would still increase with age, peak around the age of 50 and then decline, following the same hump-shaped profile that is typical for total and market income.

A summary of our incidence and tax shifting assumptions alongside the assumptions made in three previous tax incidence studies for Canada is included in Appendix A.

IV. OUR INCOME MEASURES

The four income measures retrieved from SPSPD/M and adjusted to account for the CIT, employer share of CPP/QPP and EI as well as the treatment of CPP/QPP as discussed above, are illustrated in Appendix B, with a separate diagram for each income quintile. The dark solid line represents the market income adjusted as described previously, or the pre-fisc income. This is the income individuals earn exclusively as a result of market participation. The light solid line represents consumable income, or post-fisc income — what individuals have available to consume or save after paying various taxes and receiving various transfers from the government. In between we have total income (market income plus transfers) and disposable income (total income minus taxes, with the exception of consumption taxes).

There are several points of interest:

- Even though our diagrams group together different individuals of various ages in a particular income group, the income curves look remarkably similar to typical lifetime income profiles. In fact, these diagrams show how lifetime income profiles would likely look if there were little to no income mobility, and individuals stayed in the same income quintile throughout their lifetime. Market income in particular has the expected hump shape: it grows slightly over the first two decades of the active life, peaks around the age of 45-50 (earlier for the first three quintiles, later for the fourth and the fifth) then declines more abruptly than it has increased over the second part of the active life. The peak is more pronounced and the decline more abrupt for the top 20 percent individuals (the fifth quintile.)
- For the mid quintiles (second, third and fourth) market income exceeds consumable income for most or all pre-retirement age groups, after which consumable income surpasses market income around the age of 55-65. Thus, taxpayers in these income groups are net contributors to the fisc during their active life and become net recipients in their retirement. CPP/QPP as well as OAS and GIS play a large role in this, even though, as previously explained, we do not treat CPP/QPP benefits as

²⁸ For more on the property tax incidence see Heather Kerr, Ken McKenzie and Jack Mintz eds., *Tax Policy in Canada*, Chapter 9. Canadian Tax Foundation, Toronto, Canada (2012).

pure transfers, but instead we break them down into an earned/return to savings component which is included in market income, and a transfer component which is included in the disposable and consumable income.

- However, for the first quintile, consumable income exceeds market income for all age cohorts, thus this income group is a net recipient from the fisc at any age.
- At the other extreme, for the top income earners in the fifth quintile, market income exceeds consumable income at any age, making these individuals on average net contributors to the fisc even in their retirement years. Moreover, market income also exceeds disposable income for this group, which means that individuals in this income group pay more in taxes than they receive in transfers, even if we were to exclude consumption taxes, typically viewed as regressive. In fact, their market and total income are almost identical before the age of 60 and only slightly depart after this point, which implies that transfers for this income group are almost insignificant relative to their income during their active life. This is the group for which the maximum CPP contribution is likely binding for most of their active years, and post-retirement income is too large to qualify for GIS.²⁹
- For all income groups except the first quintile, income is visibly smaller post-retirement compared to the peak earning years; the private and public pension plans as well as the other government programs geared toward the elderly cannot offset the natural decline in market income that comes with age.
- The first quintile, however, enjoys a significant increase in income after the age of 65. Despite some taxes, in particular consumption taxes, being regressive (as discussed below), for this particular income group the post-fisc income far exceeds their pre-fisc income, by a magnitude of more than four at the age of 70-74 (consumable income of \$9,324 versus market income of \$2,081) to almost six past the age of 75 (consumable income of \$11,961 versus market income of \$2,058).

V. AVERAGE TAX/TRANSFER RATES BY AGE COHORT

The difference between market income and consumable income is the result of transfers received and taxes paid by each individual. We report two aggregate measures of taxes and the corresponding tax rates:

- *Total Taxes*, which are equal to total income minus consumable income. Total taxes show the total contribution to the fisc out of the income that has been supplemented by transfers, and as such they are always positive.
- *Total Tax Rate*, equal to total taxes as a percentage of total income. It shows the average tax rate for the average individual in each age-income group. Note again that this measure ignores any transfers received by individuals that may offset their taxes, but does include transfers in the total income in the denominator. Thus it is always positive, even though some individuals receive more in transfers than they pay in taxes.

²⁹ CPP/QPP benefits are based on contributors' earning history, but there is an annual cap typically binding for above average earners. In 2008, the maximum CPP pensionable earnings amount was set at \$44,900, with a maximum CPP/QPP contribution of \$2,049.30 (each of the employer and employee portions). In turn, the maximum CPP benefit for 2008 was \$10,614. Starting with the age of 65 Canadians are also eligible for the Old Age Security (OAS) pension, which is independent of their employment history. The combined annual maximum for CPP and OAS for 2008 was \$16,641.72. In addition, low-income (below \$15,672 in 2008) recipients of OAS also qualify for the Guaranteed Income Supplement (GIS). That is obviously not the case for individuals in the top quintile with total income in 2008 exceeding \$72,000 on average for the 70-74 age cohort.

- *Net Taxes*, which equal total taxes minus transfers, or market income minus consumable income. This figure shows the net contribution to the fisc by the average individual in each group, which can be positive or negative, with the sign indicating whether an individual is a net contributor to or net recipient of the fisc.
- *Net Tax Rate*, which shows net taxes as a percentage of market income. This definition eliminates government transfers from both the numerator and the denominator of the tax rate, focusing instead on taxes paid out of pre-fisc income. For individuals with little or no market income, especially those aged 65 or older, the net tax rates are negative and unusually large in absolute value.

Table 4 below illustrates the total tax rates across age and income groups.

TABLE 4 TOTAL TAX RATES (TAXES PAID AS SHARE OF TOTAL INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	17.0%	16.6%	18.2%	23.3%	30.7%	21.1%
25-29	15.6%	21.9%	27.6%	31.4%	34.0%	26.1%
30-34	15.8%	23.9%	28.5%	31.7%	35.1%	27.0%
35-39	19.1%	23.3%	28.3%	31.9%	36.5%	27.8%
40-44	17.4%	23.1%	28.1%	31.3%	36.3%	27.2%
45-49	18.5%	24.8%	28.3%	31.4%	36.1%	27.8%
50-54	17.6%	22.6%	26.6%	29.8%	36.4%	26.6%
55-59	24.8%	20.3%	25.1%	29.0%	34.7%	26.8%
60-64	27.3%	18.0%	23.6%	26.6%	33.2%	25.7%
65-69	14.8%	12.9%	17.7%	22.0%	31.0%	19.7%
70-74	14.0%	12.1%	15.4%	19.4%	26.7%	17.5%
75+	12.4%	11.8%	13.7%	19.9%	28.7%	17.3%
All ages	17.3%	17.9%	24.5%	28.8%	34.9%	24.7%

The last row in Table 4 groups all ages together and shows the total tax rate for the average taxpayer in each income group. The tax rates generally increase with income: the first two quintiles have an average tax rate of 17-18 percent of their total income, increasing to approximately 35 percent for the individuals in the top 20 percent of the income distribution. This suggests that the tax system is overall progressive when looking at the entire population (20 and older).³⁰

When we compare tax rates across income groups within age cohorts and across age within income groups conclusions become more nuanced. Tax rates range between 11.8 percent for the average person 75 and older in the second quintile of the income distribution to 36.5 percent for the average 35-39 year old in the top 20 percent of income distribution. Total tax rates generally increase with income within each age cohort, again with the notable exception of the poorest income group. Their tax rates are lower than for the rest of the taxpayers only between the ages of 25 to 55. After the age of 55 individuals in the bottom 20 percent have higher tax rates than those in the second quintile, and for the 60-64 age cohort, the total tax rate of the lowest quintile is even larger than the tax rates of the third and fourth quintile (27.3 percent for QU1 versus 18.0 percent for QU2, 23.6 percent for QU3 and 26.6 percent for QU4). The higher tax rates of the poorest group at this age are not due to higher taxes paid in dollar terms (in absolute terms their total taxes decline slightly after the age of 50 and generally fluctuate between \$1,439 and \$1,693 beginning with the age of 55), but to the abrupt decrease in their market income after the age of 55, with transfers only increasing after the age of 65. These numbers suggest that the lower

³⁰ The last cell in Table 4 reflects the average tax rate among the five income groups for the population of all ages. That is, each income group is given the same weight. Alternatively, the average taxpayer in our dataset pays \$14,072 in taxes relative to \$47,056 in total income, which implies a total tax rate of 29.9 percent.

income individuals are particularly vulnerable in their pre-retirement years when they are too old to earn significant income through market participation, but too young to qualify for some of the government programs like GIS and OAS. We address this issue in more detail at the end of this section.

Regarding the age distribution, for all except the lowest income group tax rates follow a similar pattern. They increase substantially from the 20-24 to the 25-29 age cohort, as students are generally out of college and tuition tax credits are no longer available, but also as individuals in general gain work experience which naturally translates into increases in their market income. After the age of 29, tax rates increase very slightly with age (between 0.7 and 3.6 percentage points), peaking around the age of 50. Beyond the age of 50, tax rates gradually decline, and for the top two income quintiles the tax rates experience a slight increase after the age of 75. The fact that tax rates peak about the same time as income peaks for all but the first quintile is another argument in support of our view that the Canadian tax system is generally progressive, albeit a weaker one, since the increase in tax rates over the peak earning years is much less pronounced than the increase in market and total income.

However, total tax rates offer an incomplete picture of taxpayers' contributions to the fisc. A substantial part of taxes paid may come from public transfers rather than earned market income. Table 5 below reports transfer rates across age and income groups, calculated as a percentage of total income. We include all the transfers that individuals receive from the federal and provincial governments including EI benefits, OAS, GIS, and part of their CPP/QPP income, but excluding the share of CPP/QPP income that we model as return to savings.

TABLE 5 TRANSFER RATES (TRANSFERS RECEIVED AS SHARE OF TOTAL INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	17.7%	15.1%	10.5%	9.8%	3.1%	11.2%
25-29	39.0%	20.0%	10.0%	3.3%	0.9%	14.6%
30-34	46.5%	20.3%	10.3%	3.8%	1.4%	16.5%
35-39	39.3%	20.4%	8.5%	2.8%	0.5%	14.3%
40-44	38.3%	17.5%	5.6%	2.1%	0.4%	12.8%
45-49	37.8%	13.2%	5.2%	2.2%	0.5%	11.8%
50-54	37.9%	13.2%	4.3%	1.9%	0.4%	11.5%
55-59	45.3%	22.1%	7.1%	2.2%	0.6%	15.5%
60-64	45.0%	39.9%	17.6%	7.3%	1.9%	22.3%
65-69	80.3%	70.8%	45.1%	27.4%	10.2%	46.7%
70-74	80.8%	79.4%	51.8%	33.8%	13.2%	51.8%
75+	84.9%	74.0%	53.3%	34.5%	13.4%	52.0%
All ages	44.0%	38.1%	15.8%	6.2%	1.4%	21.1%

For all income groups transfer rates fluctuate initially, then generally decline from age 30 to 55, and increase substantially after that, with the most dramatic increase after the age of 65. Within age cohorts transfer rates generally decline with total income, as one would expect. For the oldest age group enjoying the largest transfer rates, these rates decline with income from 84.9 percent for the average individual in the bottom 20 percent to 13.4 percent for the top 20 percent of income distribution.

We next combine taxes paid and transfers received and report the corresponding net tax rates, calculated as a percentage of market or pre-fisc income in Table 6 below.

TABLE 6 NET TAX RATES (TAXES MINUS TRANSFERS AS SHARE OF MARKET INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	-0.9%	1.8%	8.6%	14.9%	28.4%	10.6%
25-29	-38.3%	2.3%	19.6%	29.1%	33.4%	9.2%
30-34	-57.2%	4.5%	20.3%	29.0%	34.2%	6.2%
35-39	-33.3%	3.6%	21.7%	29.9%	36.2%	11.6%
40-44	-33.9%	6.7%	23.9%	29.8%	36.0%	12.5%
45-49	-31.2%	13.3%	24.4%	29.8%	35.7%	14.4%
50-54	-32.7%	10.9%	23.3%	28.4%	36.2%	13.2%
55-59	-37.4%	-2.3%	19.3%	27.3%	34.3%	8.3%
60-64	-32.2%	-36.4%	7.2%	20.9%	31.9%	-1.7%
65-69	-332.8%	-197.7%	-50.0%	-7.5%	23.1%	-112.8%
70-74	-348.1%	-327.3%	-75.4%	-21.7%	15.5%	-151.4%
75+	-481.3%	-238.9%	-84.9%	-22.3%	17.7%	-162.1%
All ages	-47.7%	-32.7%	10.3%	24.0%	34.0%	-2.4%

When all age cohorts are considered together, the first two quintiles of the income distribution are net recipients of the fisc, with negative net taxes equal to -47.7 percent of their market income for the first quintile, and -32.7 percent for the second quintile. For the middle to high-income individuals net tax rates are positive and increase significantly with income, from 10.3 percent for the median group to 24.0 percent for the fourth quintile and 34.0 percent for the fifth. Thus, the tax system is overall progressive when net taxes are considered. An interesting result is that the average net tax rate across the five income groups of all ages (weighted by population) is negative, albeit small, at -2.4 percent. An alternative way to look at the average net tax rate is to consider the average individual in our dataset who pays \$9,695 in net taxes relative to a market income of \$42,679, which implies a net tax rate for the average person of 22.7 percent.

Looking at the net tax rates by age cohorts, other perhaps surprising facts come to light. The bottom 20 percent of the income distribution is a net recipient of transfers for all ages considered. Moreover, they are not the only net recipients. Starting at the age of 65, all but the top 20 percent of the income distribution are net recipients from the fisc. Part of the reason is related to the targeted transfers for the elderly like GIS and OAS. But the result remains remarkable, especially given our choice of not treating CPP/QPP benefits as pure transfers, but instead breaking them into a transfer and an earned component. As indicated in Table 3, however, for those who were 60 or older in 2008, just 47 percent of their CPP/QPP income appears to be a direct result of previous contributions, while the remaining 53 percent is a transfer from current CPP/QPP contributors. As these current contributors to CPP/QPP, who contribute more to the plan than their predecessors, retire in the future, this result may change and we may see fewer net recipients of the fisc among the elderly.

What may also seem remarkable is the magnitude of some of the net tax rates, in particular for the individuals over the age of 65 in the bottom two quintiles with net tax rates between -198 percent and -481 percent. For them, transfers received net of taxes paid exceed their market income by a factor of two to five.

Within age cohorts, net tax rates generally increase with income, which is again consistent with our previous conclusion that federal and provincial taxes in Canada are generally progressive. Across ages we notice a similar pattern to what we have observed in the case of total tax rates. For the top three

quintiles net tax rates are almost flat during their most active years between 25 and 50, with only a slight increase with age, and ranging between 20 percent and 24 percent for the third quintile, 29 percent to 30 percent for the fourth and 33 percent to 36 percent for the fifth. This is directly linked to the combination of taxes and transfers that vary across income groups as discussed below (see Figure 2).

Decomposing the Taxes

We decompose total taxes and the corresponding tax rates into two main categories of taxes: Payroll, Personal Income and Other Taxes (PPO) and Consumption Taxes.

PPO taxes include federal and provincial personal income taxes, both the employer and the employee share of payroll taxes, and other federal and provincial taxes paid by individuals, like provincial health premiums. They also include corporate income taxes indirectly paid by labour and capital owners, based on the incidence assumptions discussed above. Compared to the basic SPSD data, PPO taxes are also adjusted downward due to our treatment of part of CPP/QPP contributions as saving for retirement and not payroll taxes. Table 7 illustrates the distribution of PPO taxes across age and income groups.

TABLE 7 PERSONAL INCOME, PAYROLL AND OTHER (PPO) TAX RATES (AS SHARE OF TOTAL INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	7.1%	8.3%	10.7%	16.0%	24.5%	13.3%
25-29	6.0%	13.8%	20.1%	24.4%	28.4%	18.5%
30-34	6.4%	15.7%	21.0%	25.3%	29.4%	19.6%
35-39	8.4%	14.8%	21.2%	25.4%	31.4%	20.2%
40-44	6.8%	15.1%	20.6%	24.9%	31.5%	19.8%
45-49	8.0%	16.4%	21.3%	25.0%	31.6%	20.4%
50-54	7.5%	14.6%	19.6%	23.3%	32.4%	19.5%
55-59	12.9%	12.0%	17.6%	21.9%	30.4%	19.0%
60-64	15.2%	8.4%	15.0%	19.2%	28.3%	17.2%
65-69	5.1%	3.4%	8.4%	13.2%	24.9%	11.0%
70-74	4.7%	1.8%	5.2%	10.7%	20.1%	8.5%
75+	2.0%	2.2%	4.4%	10.5%	22.5%	8.3%
All ages	7.1%	9.0%	16.5%	21.8%	29.9%	16.9%

PPO taxes are the largest portion of taxes in our dataset and therefore display similar characteristics to total tax rates. After an initial jump around the age of 25, PPO taxes tend to increase only slightly with age up until around the age of 50 (55 for the top quintile) and then drop gradually. For the second and the fifth quintile, PPO taxes increase slightly beyond the age of 75.

Within age cohorts, PPO taxes are typically progressive. Exceptions to this are the individuals aged 55 to 75 in the lowest income quintile, who pay higher taxes not only compared to the second quintile, but even the third quintile within the 60-64 age cohort.³¹ For the remaining four quintiles, the PPO tax rate increases by an average of 5.8 percentage points moving from one quintile to the next in the income distribution.

³¹ However, as shown in Table 6 the net tax rates for the lowest income group are still by far the lowest of all quintiles for all age cohorts except 60-64, and negative throughout.

Consumption taxes are modeled in SPSPD/M and are not affected by our assumptions regarding the tax incidence of payroll or corporate income taxes, nor by our treatment of CPP/QPP contributions and benefits. We report consumption tax rates across age and income groups in Table 8 below using total income as tax base.

TABLE 8 CONSUMPTION TAX RATES (AS SHARE OF TOTAL INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	9.9%	8.3%	7.4%	7.3%	6.1%	7.8%
25-29	9.6%	8.1%	7.5%	7.0%	5.7%	7.6%
30-34	9.5%	8.2%	7.5%	6.4%	5.7%	7.4%
35-39	10.7%	8.5%	7.1%	6.4%	5.2%	7.6%
40-44	10.6%	8.0%	7.5%	6.4%	4.8%	7.5%
45-49	10.5%	8.4%	7.0%	6.4%	4.4%	7.3%
50-54	10.1%	8.0%	7.0%	6.5%	4.0%	7.1%
55-59	11.9%	8.3%	7.5%	7.0%	4.3%	7.8%
60-64	12.0%	9.6%	8.6%	7.4%	4.9%	8.5%
65-69	9.7%	9.6%	9.2%	8.7%	6.0%	8.7%
70-74	9.4%	10.3%	10.1%	8.7%	6.6%	9.0%
75+	10.4%	9.5%	9.3%	9.4%	6.2%	9.0%
All ages	10.2%	8.9%	8.0%	6.9%	5.0%	7.8%

The literature on tax incidence seems to be in a general agreement that lower income groups save less and consume a larger proportion of their annual income than the more affluent taxpayers. Hence lower income groups are more affected by consumption taxes, which are therefore regressive under annual income incidence. Our figures confirm this view; when all age groups are considered, the average consumption tax rate is 7.8 percent, decreasing from 10.2 percent for the bottom quintile to only 5.0 percent for the top quintile. Within age cohorts, consumption tax rates also generally decrease with income. One partial exception are again individuals in the bottom 20 percent of the income distribution, whose consumption tax rates between the age of 70 and 75 are lower than for the next two quintiles, in part as a result of necessities like food, rent and medical expenses being exempt from sales taxes.

Within the middle three quintiles consumption tax rates generally decline and then increase with age peaking around the age of 75, which is consistent with the fact that older people tend to save less and consume more of their income on an annual basis relative to younger ones. This is especially true in our analysis where part of savings consists of CPP/QPP contributions that decline with age.

A special type of taxes embedded in the PPO taxes reported above is what we label as *implicit taxes*. They include the CIT and the employer share of CPP/QPP and EI contributions. These taxes are not directly visible to those who ultimately bear them, since they are incurred at corporate level before these individuals observe their market income. They pay these taxes indirectly, in the form of lower wages and/or investment income as the corporate income taxes and the employer share of payroll taxes are shifted onto them. These taxes become observable as a result of the adjustments we make to the original SPSPD/M data to account for the CIT and the employer share of payroll taxes. Their magnitude is influenced by our treatment of CPP/QPP contributions as part payroll taxes and part savings for retirement. The share of CPP/QPP contributions that we model as savings for retirement is improperly labeled as payroll tax, and we exclude it from implicit taxes (i.e., we treat it as a negative implicit tax). Since this share is increasing with age, it tends to reduce the implicit taxes across age cohorts approaching retirement age, when we assume that 100 percent of CPP/QPP contributions represent saving for retirement.

We report the implicit tax rates calculated as the ratio of implicit taxes to total income in Table 9 below.

TABLE 9 **IMPLICIT TAX RATES (AS SHARE OF TOTAL INCOME)**

	QU1	QU2	QU3	QU4	QU5	Average
20-24	5.1%	4.9%	5.1%	5.2%	5.6%	5.2%
25-29	3.3%	4.6%	5.1%	5.3%	5.5%	4.8%
30-34	2.9%	4.3%	5.0%	5.1%	5.2%	4.5%
35-39	3.4%	4.3%	4.9%	5.1%	5.7%	4.7%
40-44	2.8%	3.5%	4.1%	4.3%	5.5%	4.0%
45-49	3.2%	3.8%	4.2%	4.2%	6.0%	4.3%
50-54	2.6%	2.1%	2.1%	2.8%	5.4%	3.0%
55-59	2.8%	2.3%	1.9%	2.6%	5.1%	3.0%
60-64	2.5%	2.2%	2.4%	2.5%	4.9%	2.9%
65-69	0.8%	1.0%	1.8%	2.2%	5.1%	2.2%
70-74	0.8%	0.6%	1.5%	1.5%	3.8%	1.6%
75+	0.6%	1.1%	1.7%	2.4%	4.6%	2.1%
All ages	2.8%	2.6%	3.4%	3.8%	5.4%	3.6%

Although smaller relative to consumption taxes, implicit taxes still represent a significant share of total income, with an average implicit tax rate of 3.6 percent across the five quintiles.³² Implicit taxes are mildly progressive, increasing generally with income within each age cohort, with some exceptions within the bottom 40 percent of taxpayers. Interestingly, after the age of 50, the top income quintile has an implicit tax rate 1.9 to 2.5 times larger than the next income group. As predicted, the implicit tax rates also generally decrease with age within each income group (less so for the top income groups than the rest) and the population overall, from an average of 5.2 percent for the 20-24 cohort to 1.6 percent for the 70-74 cohort. The lowest implicit tax rate of 0.6 percent is incurred by the first quintile of income distribution in the 75+ age cohort, as well as the second quintile of the 70-74 age cohort. At the other end of the spectrum, the top 20 percent of earners in the 45-49 age group bear the highest implicit tax rate, at 6.0 percent, due mainly to a large increase in capital income at this age and the 30 percent share of CIT borne by it. In absolute terms, the implicit tax rate peaks at the same time as market income and total income peak, around the age of 50-55.

Figure 1 below summarizes the tax rates discussed above for the entire population 20 years and older, as a percentage of total income, with transfer rates shown as negative taxes for comparison. The aggregate tax rate increases with income while the transfer rate decreases with income, evidence that when looking at the entire population the Canadian tax system is generally progressive.

³² Once again, this is the average of the implicit tax rates for the five income groups of all ages. The implicit tax rate for the average taxpayer is slightly larger at 4.4 percent.

FIGURE 1 TAX AND TRANSFER RATES ACROSS INCOME GROUPS, ALL AGES

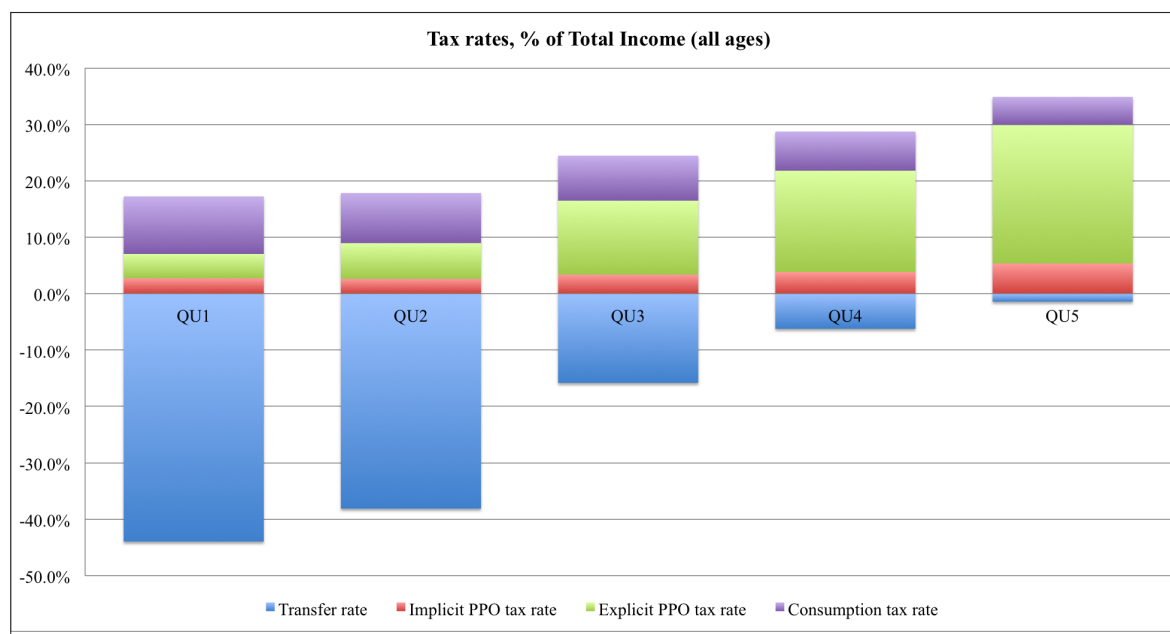
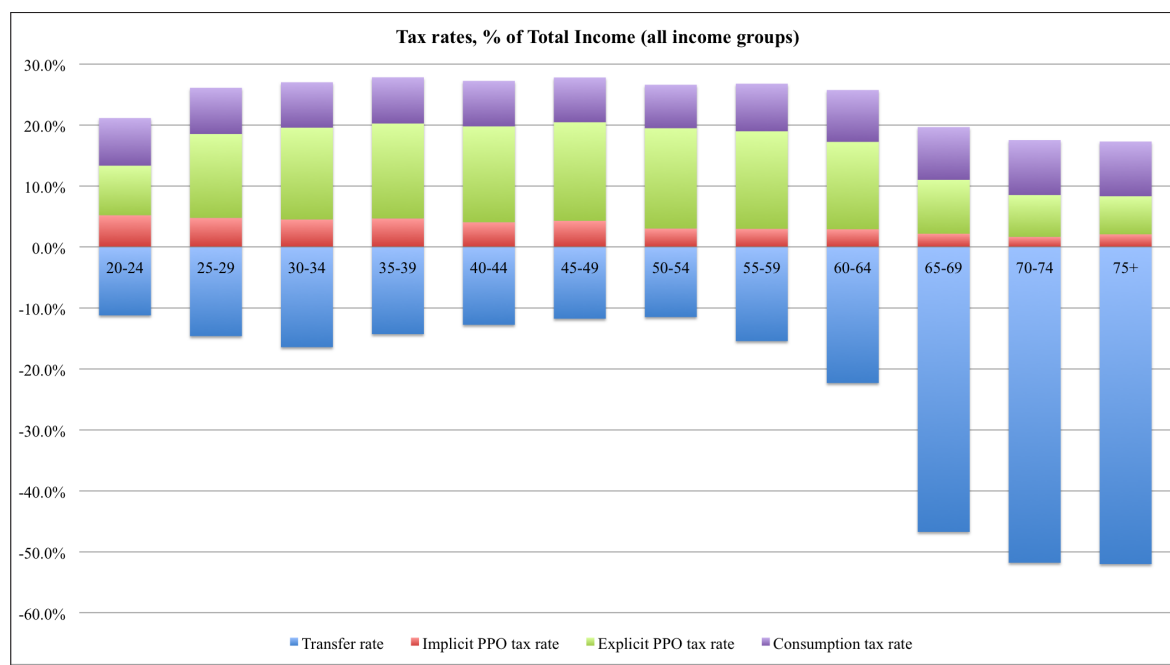


Figure 2 summarizes the same tax rates across age cohorts, reinforcing our previous observations that Canada has a transfer system relatively generous for older cohorts, while tax rates exhibit a mild increase with age until around the age of 50, followed by a gradual decrease.

FIGURE 2 TAX AND TRANSFER RATES ACROSS AGES, ALL INCOME GROUPS



We return here to the comparison between the tax rates paid by the first two quintiles of the income distribution. With consumption taxes generally regarded as regressive in the literature, it is no surprise that the consumption tax rates for the first quintile are indeed larger than for the second, for all but the

70-74 cohort (Table 8). What may be surprising, however, is that between the ages of 55 and 75 the lowest income group also pays higher PPO taxes (Table 7), and overall higher total taxes relative to their total income (Table 4), even though we have found these taxes to be otherwise progressive. One of the possible reasons for this is our choice to work with individual income. Some of the lowest income earners may be members of higher income households, and their tax rates may be lower in the broader household context. However, there are several other factors behind this result, which we explore here.

Table 10 below reports the income ratio of the first two quintiles for the main income definitions we use in this study.

TABLE 10 QU1/QU2 INCOME RATIO

	Market Income	Total Income	Disposable Income	Consumable Income	Labour Income	Capital Income
20-24	39.5%	40.8%	41.3%	40.6%	38.2%	112.4%
25-29	31.3%	41.0%	44.8%	44.3%	30.1%	38.5%
30-34	26.2%	38.9%	43.2%	43.0%	24.6%	52.7%
35-39	28.9%	37.9%	40.8%	40.0%	26.9%	51.4%
40-44	28.4%	38.0%	41.7%	40.8%	24.4%	110.8%
45-49	26.6%	37.1%	40.9%	40.2%	23.5%	77.9%
50-54	24.6%	34.3%	37.2%	36.6%	18.3%	70.4%
55-59	22.4%	31.8%	31.5%	30.0%	18.5%	46.7%
60-64	30.7%	33.6%	31.1%	29.8%	17.5%	47.1%
65-69	41.8%	62.1%	61.0%	60.8%	22.4%	50.1%
70-74	59.9%	64.3%	62.4%	62.8%	-275.9%	80.8%
75+	42.8%	73.9%	74.1%	73.4%	467.5%	40.9%
All ages	38.4%	42.5%	43.4%	42.8%	38.9%	46.4%

The first quintile earns less than 40 percent of the market income earned by the second quintile prior to the age of 65, and slightly more after that, with an average of 38 percent for all age groups. With the addition of transfers though, the total income ratio is significantly improved to an average of 43 percent for all ages. However, the fiscal system does a much better job at equalizing income from the age of 65 onward, where the total income ratio QU1 to QU2 increases above 0.6. After PPO taxes are being paid, which leads to the disposable income, for all ages except the 55-75 interval the disposable income ratio is still higher than the total income ratio. Thus income inequality is further reduced after PPO taxes are considered, which is another indication that PPO taxes are generally progressive. However this does not hold true for the lowest income quintile of the 55-75 age cohort, for whom the ratio of disposable income relative to the second quintile is approximately 1.4 percentage points lower than the total income ratio. With the exception of the 70-74 cohort, everybody else in the first quintile experiences a further decrease in their income ratio relative to the second quintile as consumption taxes are also subtracted to arrive at the consumable income ratio.

When all taxes and transfers are considered together, the consumable income ratio QU1 to QU2 is higher than the market income ratio for all but the 60-64 age group. Thus, even though not all taxes are progressive, the overall fiscal system is progressive. For the 60-64 year-olds however, the average person in the bottom quintile earns 30.7 percent of the market income of the average person in the second quintile, but ends up with only 29.8 percent of the disposable income of the same person. In a sense, the fiscal system fails this group. These may be individuals who are too old to change careers and earn more income on their own, but too young to fully benefit from the generosity of the Canadian transfer system toward the elderly.

VI. ALTERNATIVE SCENARIO: CORPORATE INCOME TAXES BORNE BY CAPITAL

Although we believe that in a small open economy labour bears most of the burden of corporate income taxes, we also consider the alternative scenario whereby the burden of the CIT falls entirely on owners of capital. This would correspond to either the view that equity capital is only provided domestically (extreme home bias), or the view that capital bears the tax up to the common world rate, and only the portion of CIT that is above the world rate can be shifted onto labour. However, since data published by Cansim show that roughly 30 percent of non-financial assets in Canada are owned by foreigners, in this scenario foreign capital owners will bear some of the CIT taxes. Thus for our *alternative scenario* we assume that 70 percent of CIT revenues are added back to Canadian capital income, while 30 percent of CIT in Canada is borne by foreign capital owners.

Changing the CIT incidence assumption and the way we adjust incomes to account for this tax will modify individuals' market income and total income relative to the previous scenario, but not their disposable and consumable income.³³ By way of consequence, it will also affect the dollar amount of total and net taxes, as well as PPO taxes, including the implicit share of PPO taxes, but it will have no effect on the dollar amount of transfers and consumption taxes. The combined effect of changes in the income measures we use as a tax base, as well as some of the tax amounts, is that all tax rates will change relative to the previous scenario, but not necessarily in the same direction.

We report the total tax rates, net tax rates, PPO tax rates, implicit tax rates and consumption tax rates for the new CIT treatment in Appendix C. Even without the specific numbers, one would expect the burden of CIT to be larger under the original scenario for all individuals that earn significantly more labour income relative to capital income; as a result their market and total income once adjusted for this tax should also be higher in the baseline scenario.³⁴ As labour income tends to decline with age more than capital income, we would expect this to hold mostly for the younger individuals in our dataset.

Indeed, by comparing the actual data in the two scenarios, we note that the above inference is valid for all individuals up to the age of 50, regardless of the income group they belong to. It continues to hold for the middle three quintiles between the age of 50 and 60, and for the third and fourth quintile between the ages of 60 and 65. In summary, for all these age-income combinations changing the assumption regarding the CIT results in the following changes:

- Market and total income adjusted to account for the CIT paid fall in the new CIT scenario relative to the the baseline scenario;
- The implicit taxes paid, of which CIT is a major component, fall; PPO taxes, total taxes and net taxes fall by the same amount;
- With both the tax amount and the tax base falling by the same amount, the PPO tax rate, the implicit tax rate, the total and the net tax rates all decline;
- With only the tax base falling and the numerator staying constant, the transfer rate as well as the consumption tax rate will rise.

How much does the change in the assumption regarding the CIT incidence alter the picture? Not that much, it turns out. The total tax rates for all ages in the baseline and the alternative scenario are 17.3

³³ In the baseline model, adjusting incomes for the CIT paid entails increasing labour income by approximately 5 percent and investment income by approximately 19 percent. In the alternative scenario we only need to adjust capital income, which increases by approximately 45 percent.

³⁴ In our dataset, this applies to all individuals with a ratio of labour income to capital or investment income that exceeds approximately 5.5.

percent versus 16.7 percent for the first quintile, 17.9 percent vs. 17.1 percent for the second, 24.5 percent vs. 23.0 percent for the third, 28.8 percent vs. 27.0 percent for the fourth, and 34.9 percent vs. 34.4 percent for the top income quintile. The weighted average total tax rate over all age-income groups is 24.7 percent assuming the CIT falls mostly on labour, compared to 23.6 percent if we assume that CIT falls on capital. For those that experience a lower total tax rate under the alternative CIT incidence, this decline amounts to less than 2.0 percentage points on average, while for those that experience an increase in their total tax rate (the elderly), this increase is on average equal to only 1.1 percentage points.

One conclusion we can draw from this experiment is that the incidence of corporate taxes, while generating interesting theoretical debates, does not greatly influence the overall assessment of tax incidence in Canada, primarily because corporate income tax revenues represent a relatively small share of total revenue collected (e.g., less than a third of the personal income tax revenues).³⁵

VII. INCOME INEQUALITY AND REDISTRIBUTION BY AGE COHORT

After accounting for who pays taxes, we undertake an analysis of the impact of taxation on income inequality and redistribution by age cohort. Most studies of income inequality do not distinguish by age, but rather focus on the entire population. It is also useful, however, to understand what is happening on an age basis.

To undertake the analysis we employ the concept of the Gini coefficient, which is a common measure of income dispersion. A Gini coefficient of zero represents perfect income equality (i.e., if all individuals had the same income), while a value of one represents maximum income inequality (i.e., if one individual has all of the income). Thus, higher values of the Gini coefficient represent more income inequality.

We calculate Gini coefficients on an age cohort basis for both market income (which we also refer to as pre-fisc income, before any taxes or transfers) and consumable income (post-fisc income). For market income we present the results under the assumption that labour bears most of the burden of the corporate income tax; the analysis for our alternative scenario where capital owners bear most of the burden is similar.

The Gini coefficient for all age groups for market income in our data set is 0.548; for consumable income it is 0.427. A couple of points are salient here. First, income inequality in terms of consumable income is lower than for market income. This reflects the fact discussed above that the tax and transfer system is progressive, and redistributes income from higher income groups to lower income groups. This is a standard result. Second, both the pre- and post-fisc Gini coefficients for our dataset are slightly higher than are typically calculated for Canada.³⁶ This is the case for two reasons. The first is that our dataset is based on individual incomes only; this was necessary in order to undertake the cohort analysis that is the focus of this paper. The second is that, as discussed above, we adjust market and consumable income to account for corporate taxes, payroll taxes, etc. Both of these factors tend to increase the Gini coefficient.

Figure 10 presents pre- and post-fisc Gini coefficients by age cohorts against the overall Gini coefficient for all ages (20 years and older). Several things are noteworthy. Focusing first on market income, it is

³⁵ See Chapter 1 in Kerr et al., *Tax Policy in Canada* (2012). In 2007, according to International Monetary Fund data, personal income tax revenues and corporate income tax revenues amounted to 12.4 percent and 3.7 percent, respectively, of Canadian GDP.

³⁶ See for example Kevin Milligan, "Income Inequality and Income Taxation in Canada: Trends in the Census, 1980-2005," *School of Public Policy Research Paper* 6, no.24 (2013).

evident that pre-fisc market income inequality increases with age. Starting at age 30 income inequality within an age cohort increases monotonically with age, leveling off at 65. As far as we know this is the first time that this tendency has been identified.

In terms of consumable income we see that, as we would expect, post-fisc income inequality is much lower than pre-fisc inequality due to the progressive nature of the tax and transfer system. Moreover, the trend in the post-fisc Gini generally tracks the pre-fisc Gini up to age 65 and then drops significantly, representing much lower post-fisc income inequality among older individuals. This reflects the high implicit transfers embedded in the CPP/QPP system discussed above, redistributive programs aimed at the lower income elderly, such as OAS and GIS, and features of the tax system such as the pension income amount, etc.

It is also noteworthy that for all age groups except the 50-65 cohort, the age-specific post-fisc Gini coefficient is lower than the Gini coefficient for the entire population. Post-fisc income inequality in Canada is thus smaller in the context of age cohorts than a single Gini number calculated for the entire population might suggest. In other words, a significant factor behind income inequality in Canada may be age and natural income differences that occur over the course of a lifetime.

This observation may have important policy implications, especially now that income inequality has emerged as the topic *du jour*. An increasing body of research highlights the increase in income inequality in the developed countries and calls for action. For example, in his popular book *Capital in the Twenty-First Century*, Thomas Piketty highlights the role that capital income has played in increasing inequality.³⁷ Our results suggest that this increased income inequality may be in part the result of increased life expectancy. Since market income and labour earnings in particular decrease with age after peaking around the age of 45-55, the longer people live and the larger the proportion of the elderly in the general population, the higher the Gini coefficient for pre-fisc income will be. It is important to emphasize again, however, that the Gini coefficient is significantly decreased in Canada through fiscal policy, especially for the elderly.

The very high degree of redistribution aimed at the older age cohorts in Canada is also illustrated in Figure 11, which presents the Redistribution Factor (R-Factor) by age cohort. The R-Factor is measured as the percentage decline in the pre-fisc Gini due to the tax and transfer system.³⁸ The R-Factor is relatively stable across all age cohorts until about age 65, at which point it increases significantly. This again emphasizes the high degree of redistribution geared towards the elderly in Canada.

³⁷ Thomas Piketty, *Capital in the Twenty-First Century*, Harvard University Press (2014).

³⁸ (Adjusted Market Income Gini – Adjusted Consumable Income Gini)/Adjusted Market Income Gini.

FIGURE 3 PRE- AND POST-FISC GINI COEFFICIENTS

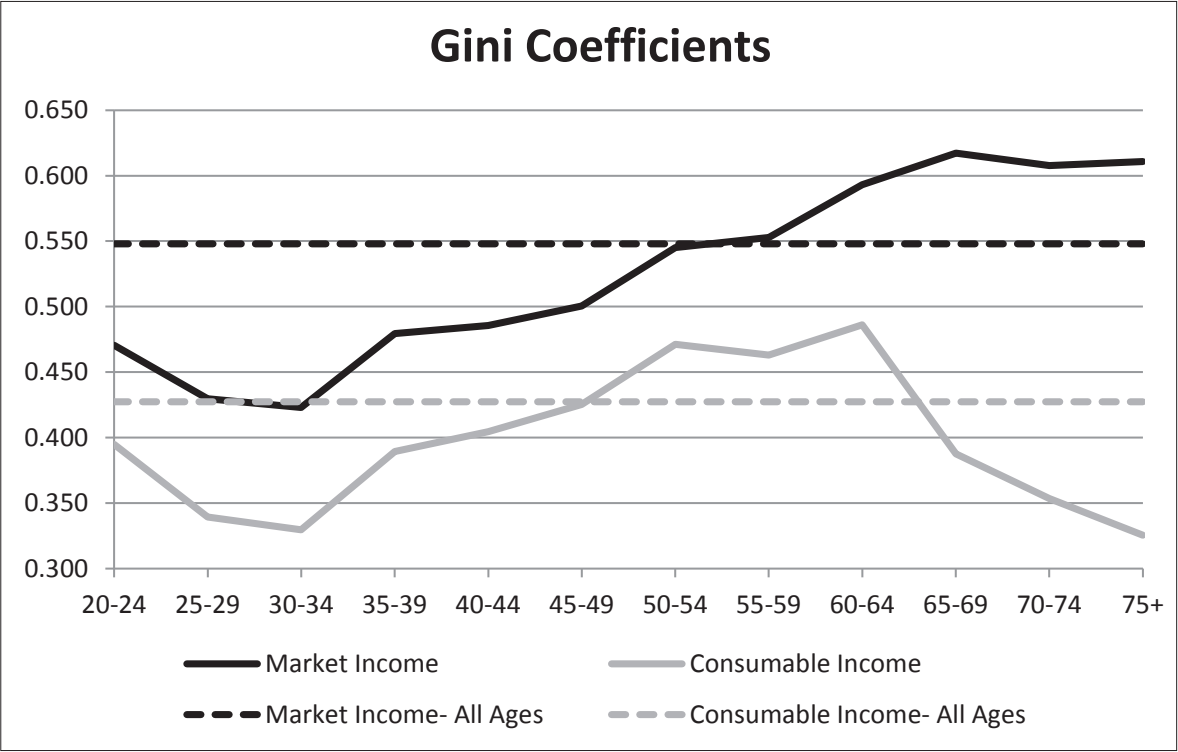
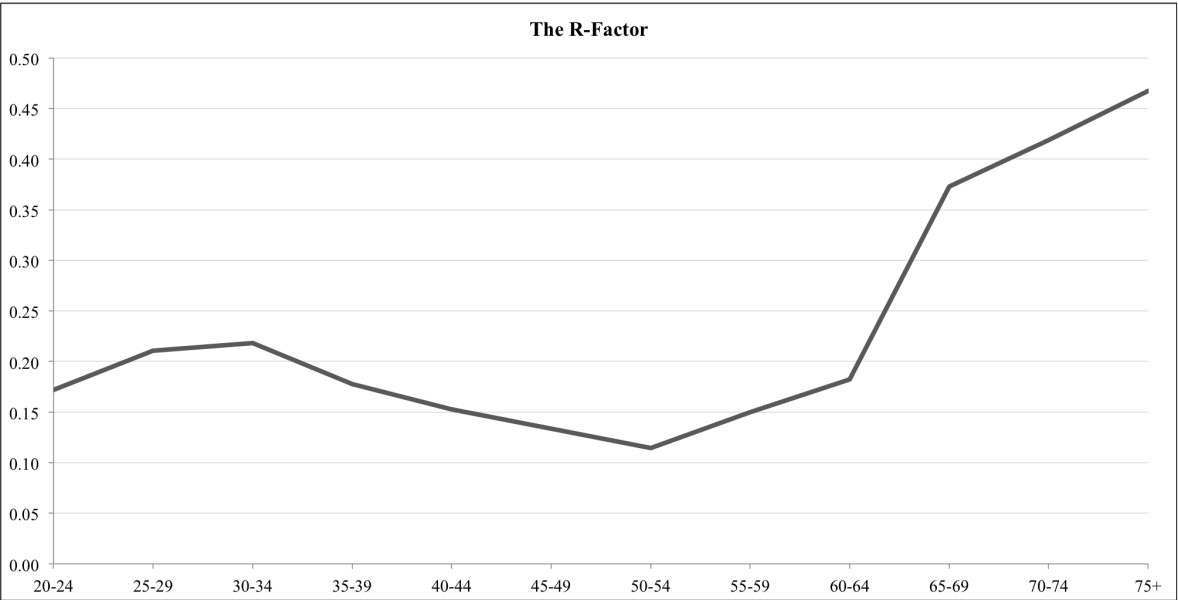


FIGURE 4 THE REDISTRIBUTION FACTOR (R-FACTOR)



VI. CONCLUSIONS

In this paper, we examine the incidence of taxes and transfers in Canada. The analysis is based on standard, or static, annual income measures.

Our analysis is unique in several ways. For the first time in a Canadian context, we disaggregate results by age group. Previous studies have examined tax incidence and redistribution across the entire population. Next, we take into account various assumptions regarding the economic incidence of taxes, especially with respect to business-level corporate and payroll taxes, which under our base scenario are shifted back to immobile factors such as labour through lower real incomes. We think that this scenario is the most reasonable one for a small open economy like Canada. We also use an innovative approach to analyze the incidence of CPP/QPP to account for its hybrid nature as a tax/transfer and pure saving system.

Overall, we find that the Canadian tax/transfer system is quite progressive. In our base case scenario, when all age cohorts are considered together, and transfers are treated as negative taxes, the first two quintiles of the income distribution are net recipients of the fisc, with negative net taxes equal to -47.7 percent of their adjusted market income for the first quintile, and -32.7 percent for the second quintile. For middle to high-income individuals net tax rates are positive and increase significantly with income, from 10.3 percent for the median group, to 24.0 percent for the fourth quintile and 34.0 percent for the fifth quintile. Thus, the tax system is overall quite progressive when net taxes are considered.

Looking at the net tax rates by age cohort, we show that the bottom 20 percent of the income distribution is a net recipient of transfers for all ages. Moreover, on average for individuals 65 and over, all but the top 20 percent of the income distribution are net recipients from the fisc, with negative net tax rates.

We also consider an alternative scenario regarding the incidence of corporate income taxes. While there are some differences, the overall results remain the same. This is largely due to the fact that corporate income tax revenue is quite low relative to personal income and consumption taxes.

We also undertake an examination of pre- and post-fisc income inequality across age cohorts, calculating within age group Gini coefficients for each cohort. To our knowledge this is the first time this has been done. We conclude that the degree of inequality varies significantly by age cohorts in Canada. Starting at age 30 income inequality within an age cohort rises monotonically with age, leveling off at 65. Moreover, we show that there is substantial redistribution on the part of the fisc for all age groups, with post-fisc inequality significantly lower than pre-fisc inequality. However, the degree of redistribution varies significantly by age group, with the degree of redistribution increasing sharply for those over 65 years of age, largely a result of the transfers available to the elderly in the form of OAS, GIS and other targeted measures.

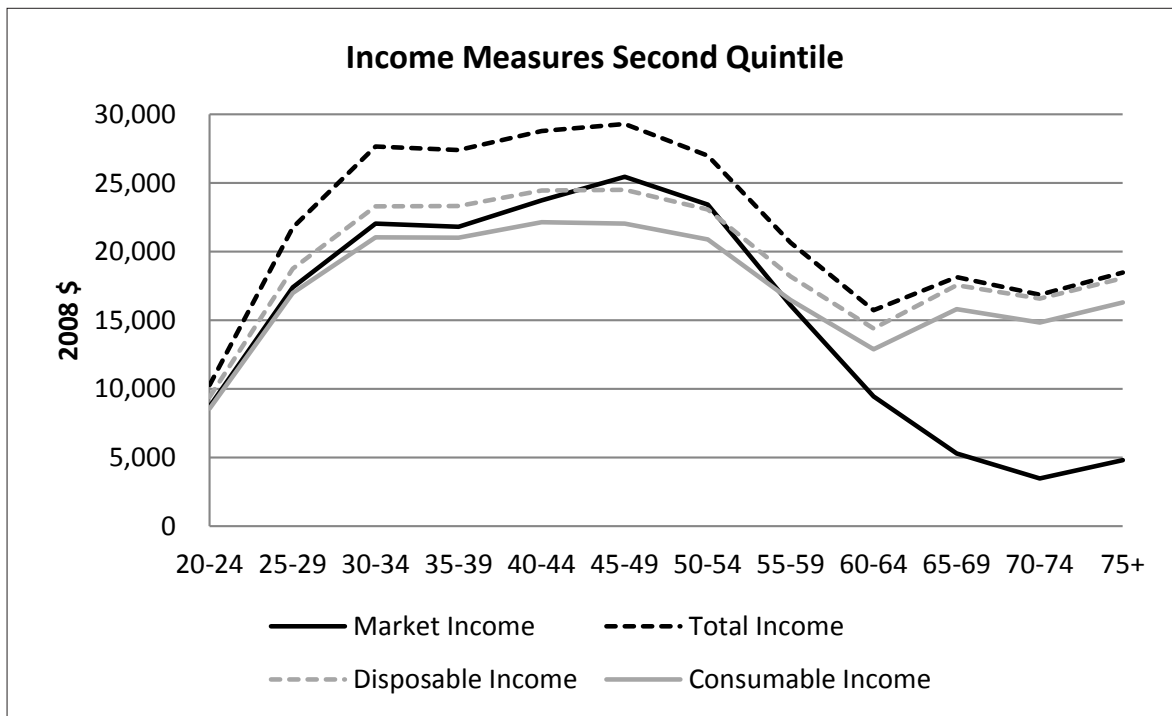
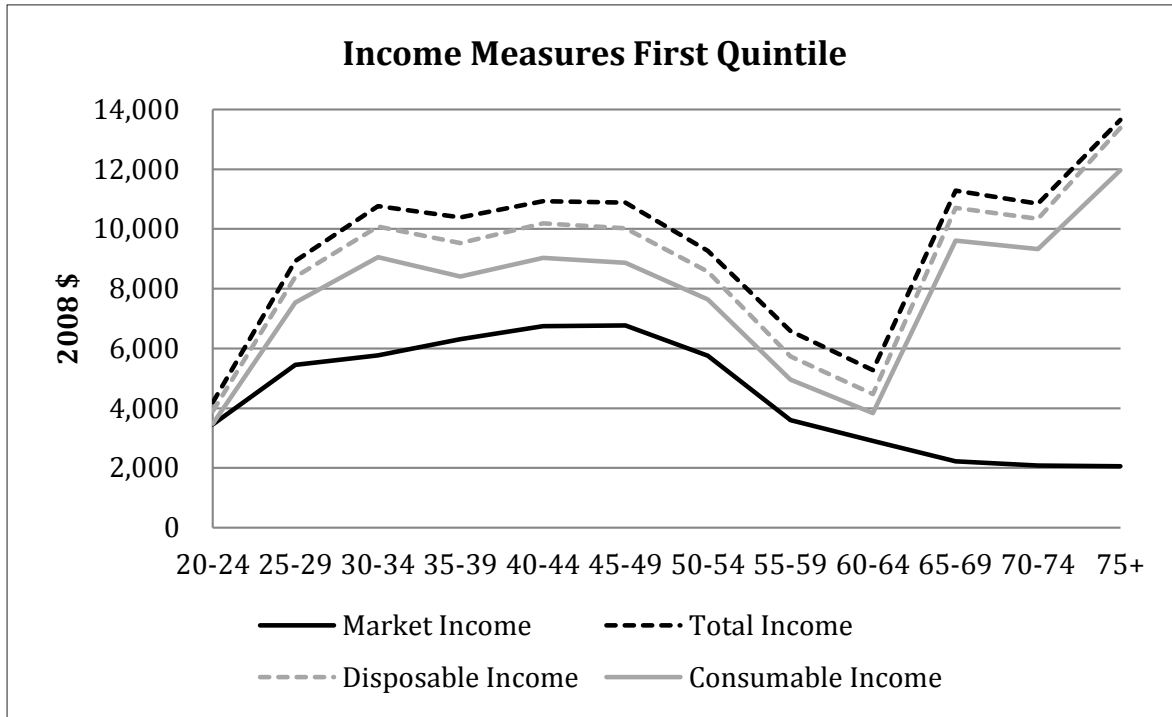
APPENDIX A

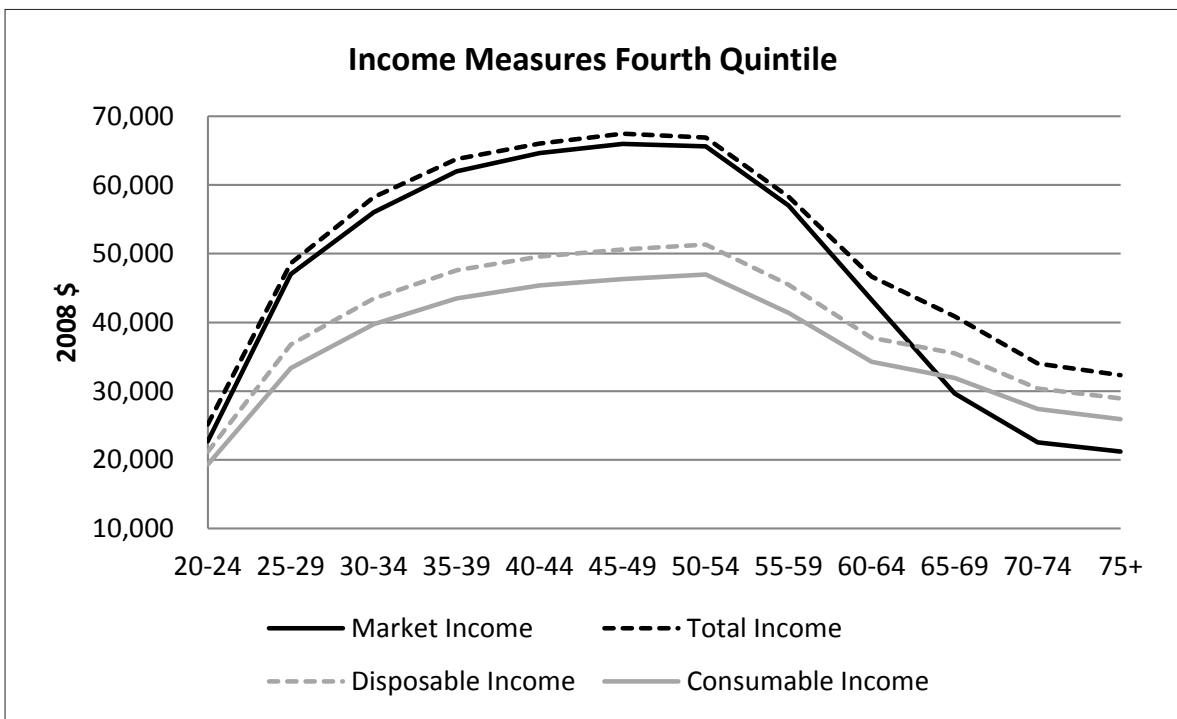
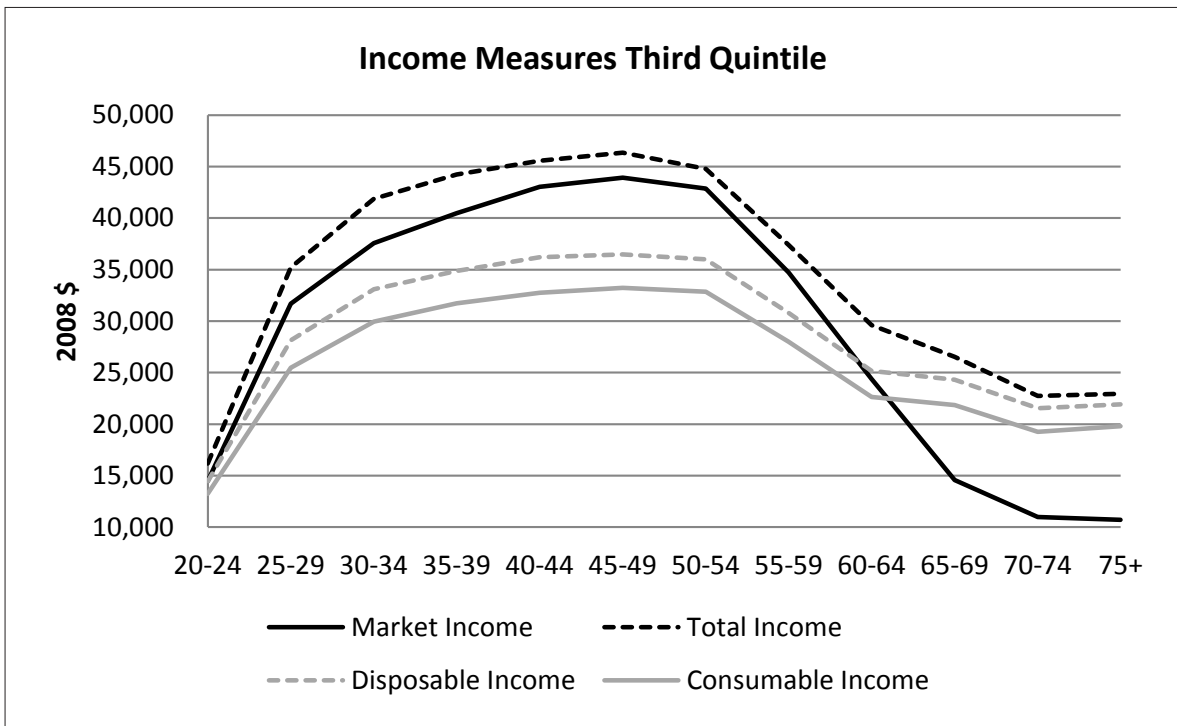
COMPARATIVE VIEW OF TAX INCIDENCE ASSUMPTIONS

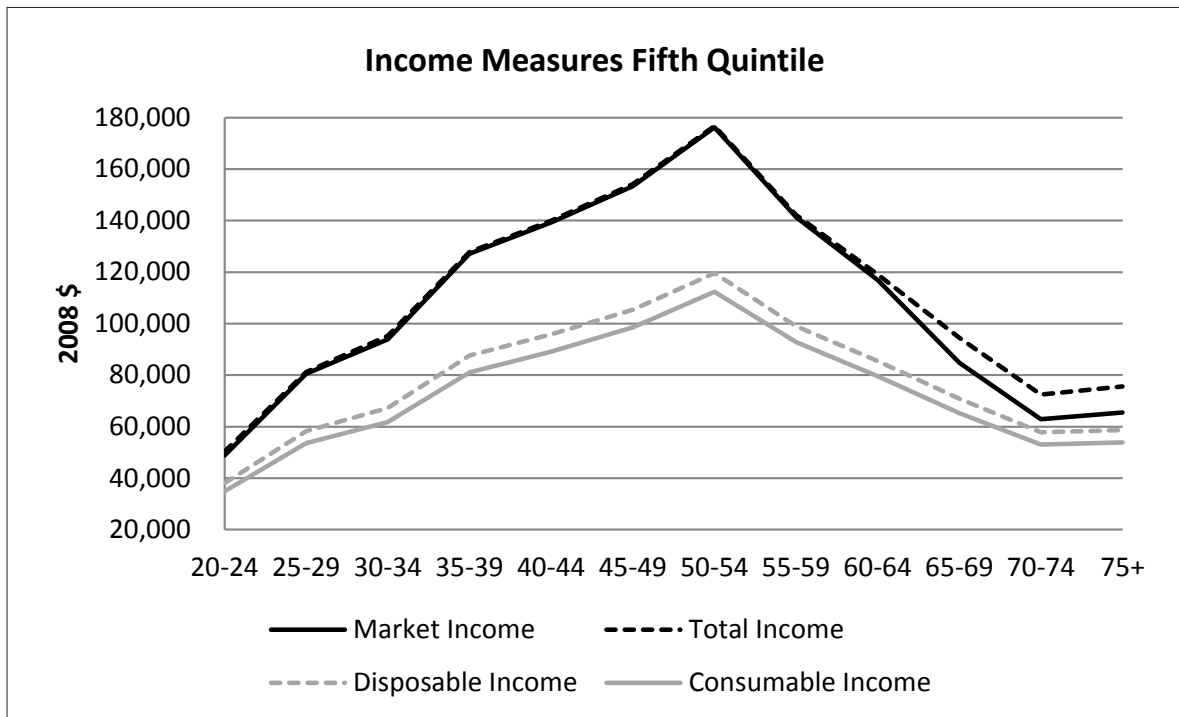
<i>Our assumptions</i>	<ul style="list-style-type: none"> • Personal income taxes borne by income recipients. • Payroll taxes: both employer and employee share borne by employees. • Payroll tax treatment: <ul style="list-style-type: none"> • EI is a tax/transfer; • CPP/QPP contributions are part savings for retirement and part payroll tax; • CPP/QPP income is part market income and part transfers. • Corporate income taxes (CIT): <ul style="list-style-type: none"> • Baseline case: 70% of CIT borne by labour, 30% by capital; • Alternative case: 70% of CIT borne by Canadian capital, 30% borne by foreign capital; • The distributive series for CIT are employment income and investment income. • Consumption taxes borne by consumers. • Property taxes not included.
<i>Davie et al. (1984), "Some Calculations of Lifetime Tax Incidence"</i>	<ul style="list-style-type: none"> • Income taxes borne by income recipients. • Corporate and property taxes borne by recipients of investment income: <ul style="list-style-type: none"> • The distributive series for taxes borne by capital in lifetime incidence calculations is the discounted value of all investment income received over a lifetime. • Social security taxes borne by earnings recipients. • Sales and excise taxes borne in proportion to consumption.
<i>Vermaeten et al. (1994), "Tax Incidence in Canada"</i>	<p><u>Standard case:</u></p> <ul style="list-style-type: none"> • CIT borne by corporate capital up to the common world (US) tax rate; the differential rate (above world rate) borne by immobile domestic factors or consumer outlays. • Payroll taxes: both employer and employee portion borne by employees. • Property taxes: portion on land borne by owners, portion on residential structures borne by users, portion on commercial and farm structures borne by consumers. <p><u>Progressive Case</u></p> <ul style="list-style-type: none"> • Same treatment of CIT. • Payroll taxes: employee portion borne by employees; employer portion borne by owners of capital. • Property taxes: both portion on land and on structures borne by owners. <p><u>Regressive Case</u></p> <ul style="list-style-type: none"> • CIT borne half by owners of corporate capital, half by consumers. • Payroll taxes: employee portion borne by employees; employer portion borne by consumers. • Property taxes: portion on land borne by owners, portion on residential structures borne by users, portion on commercial and farm structures borne by consumers.
<i>Lee, Marc (2007), "Eroding Tax Fairness. Tax Incidence in Canada, 1990 to 2005," Canadian Centre for Policy Alternatives</i>	<ul style="list-style-type: none"> • CIT borne by corporate capital up to the common world/US tax rate; differential rate borne by consumers and employees. • Payroll taxes borne by employees. • Consumption and property taxes paid by businesses borne by employees through lower wages.

APPENDIX B

INCOME MEASURES BY AGE AND INCOME GROUP







APPENDIX C

TAX RATES FOR THE ALTERNATIVE SCENARIO - CIT BORNE BY CAPITAL

TABLE C1 TOTAL TAX RATES (AS SHARE OF TOTAL INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	14.8%	13.9%	15.3%	20.5%	28.4%	18.6%
25-29	13.7%	19.4%	25.0%	28.5%	31.8%	23.7%
30-34	14.5%	21.7%	26.1%	29.1%	32.9%	24.9%
35-39	17.9%	21.2%	25.7%	29.3%	35.3%	25.9%
40-44	16.3%	20.6%	25.5%	28.7%	35.5%	25.3%
45-49	18.0%	22.7%	25.8%	28.7%	35.9%	26.2%
50-54	17.6%	20.8%	24.3%	27.5%	36.4%	25.3%
55-59	25.8%	19.8%	23.4%	27.3%	34.7%	26.2%
60-64	28.6%	18.5%	23.4%	26.5%	33.7%	26.1%
65-69	15.5%	13.8%	18.8%	22.9%	32.9%	20.8%
70-74	14.8%	12.7%	16.8%	20.6%	29.0%	18.8%
75+	13.1%	13.0%	15.4%	22.2%	31.7%	19.1%
All ages	16.7%	17.1%	23.0%	27.0%	34.4%	23.6%

TABLE C2 TRANSFER RATES (AS SHARE OF TOTAL INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	18.1%	15.6%	10.9%	10.2%	3.2%	11.6%
25-29	39.8%	20.7%	10.4%	3.4%	0.9%	15.0%
30-34	47.2%	20.9%	10.6%	3.9%	1.4%	16.8%
35-39	39.9%	21.0%	8.8%	2.9%	0.5%	14.6%
40-44	38.8%	18.1%	5.8%	2.2%	0.5%	13.0%
45-49	38.1%	13.5%	5.4%	2.2%	0.5%	11.9%
50-54	37.9%	13.5%	4.4%	1.9%	0.4%	11.6%
55-59	44.7%	22.2%	7.3%	2.3%	0.6%	15.4%
60-64	44.2%	39.7%	17.7%	7.3%	1.9%	22.1%
65-69	79.6%	70.0%	44.5%	27.1%	9.9%	46.2%
70-74	80.1%	78.8%	50.9%	33.3%	12.8%	51.2%
75+	84.2%	72.9%	52.2%	33.5%	12.8%	51.1%
All ages	44.3%	38.5%	16.1%	6.4%	1.4%	21.3%

TABLE C3 NET TAX RATES (TAXES MINUS TRANSFERS AS SHARE OF MARKET INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	-4.1%	-2.0%	5.0%	11.5%	26.0%	7.3%
25-29	-43.5%	-1.6%	16.3%	26.0%	31.2%	5.7%
30-34	-61.9%	1.0%	17.4%	26.2%	32.0%	3.0%
35-39	-36.5%	0.3%	18.6%	27.1%	34.9%	8.9%
40-44	-36.9%	3.2%	20.9%	27.1%	35.2%	9.9%
45-49	-32.5%	10.6%	21.5%	27.1%	35.6%	12.5%
50-54	-32.7%	8.4%	20.8%	26.1%	36.2%	11.8%
55-59	-34.1%	-3.1%	17.3%	25.7%	34.3%	8.0%
60-64	-27.8%	-35.0%	6.9%	20.7%	32.4%	-0.6%
65-69	-314.7%	-187.8%	-46.3%	-5.8%	25.5%	-105.7%
70-74	-327.8%	-312.1%	-69.5%	-19.1%	18.6%	-142.0%
75+	-451.6%	-221.6%	-77.0%	-17.0%	21.6%	-148.9%
All ages	-49.5%	-34.6%	8.2%	22.1%	33.4%	-4.1%

TABLE C4 PERSONAL INCOME, PAYROLL, AND OTHER TAX RATES (AS SHARE OF TOTAL INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	4.6%	5.3%	7.6%	13.0%	22.0%	10.5%
25-29	3.8%	11.1%	17.2%	21.2%	25.9%	15.9%
30-34	4.9%	13.3%	18.4%	22.5%	27.1%	17.2%
35-39	7.1%	12.5%	18.3%	22.6%	30.0%	18.1%
40-44	5.5%	12.4%	17.7%	22.2%	30.6%	17.7%
45-49	7.4%	14.1%	18.5%	22.1%	31.5%	18.7%
50-54	7.5%	12.6%	17.1%	20.8%	32.4%	18.1%
55-59	14.1%	11.4%	15.7%	20.2%	30.4%	18.4%
60-64	16.8%	9.0%	14.8%	19.0%	28.8%	17.7%
65-69	5.9%	4.3%	9.7%	14.2%	27.0%	12.2%
70-74	5.5%	2.5%	6.8%	12.0%	22.6%	9.9%
75+	2.8%	3.6%	6.4%	13.1%	25.7%	10.3%
All ages	6.4%	8.2%	14.9%	19.9%	29.4%	15.8%

TABLE C5 IMPLICIT TAX RATES (AS SHARE OF TOTAL INCOME)

	QU1	QU2	QU3	QU4	QU5	Average
20-24	2.6%	1.8%	1.8%	1.8%	2.4%	2.1%
25-29	1.1%	1.5%	1.7%	1.4%	2.3%	1.6%
30-34	1.4%	1.6%	1.8%	1.4%	2.1%	1.7%
35-39	2.0%	1.6%	1.5%	1.5%	3.8%	2.1%
40-44	1.5%	0.5%	0.5%	0.8%	4.2%	1.5%
45-49	2.6%	1.2%	0.8%	0.6%	5.7%	2.2%
50-54	2.6%	-0.2%	-1.0%	-0.4%	5.5%	1.3%
55-59	4.1%	1.7%	-0.4%	0.4%	5.1%	2.2%
60-64	4.3%	2.8%	2.2%	2.3%	5.6%	3.4%
65-69	1.7%	2.0%	3.1%	3.3%	7.7%	3.6%
70-74	1.7%	1.4%	3.1%	2.9%	6.8%	3.2%
75+	1.4%	2.4%	3.7%	5.2%	8.5%	4.2%
All ages	2.1%	1.8%	1.5%	1.5%	4.6%	2.3%

About the Authors

Dr. Jack Mintz

The James S. & Barbara A. Palmer Chair in Public Policy

Jack M. Mintz was appointed the Palmer Chair in Public Policy at the University of Calgary in January 2008.

Widely published in the field of public economics, he was touted in a 2004 UK magazine publication as one of the world's most influential tax experts. He serves as an Associate Editor of *International Tax and Public Finance* and the *Canadian Tax Journal*, and is a research fellow of CESifo, Munich, Germany, and the Centre for Business Taxation Institute, Oxford University. He is a regular contributor to the *National Post*, and has frequently published articles in other print media.

Dr. Mintz presently serves on several boards including Imperial Oil Limited, Morneau Shepell, and as Chair of the Social Sciences and Humanities Research Council. He is also appointed by the Federal Minister of Finance to the Economic Advisory Council to advise on economic planning.

Dr. Mintz has consulted widely with the World Bank, the International Monetary Fund, the Organization for Economic Co-operation and Development, and various governments, businesses and non-profit organizations in Canada.

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Kenneth J. McKenzie is a Professor in the Department of Economics and The School of Public Policy at the University of Calgary, where he has been since 1992. He received his B.Comm. from the University of Saskatchewan in 1982, his M.A. from the University of Calgary in 1985 and his Ph.D. from Queen's University in 1990. From 1984 to 1986 he was an economist in the Tax Policy Branch of the federal Department of Finance. His first academic appointment was at the University of Toronto in 1990. His principal area of research is public economics, with an emphasis on taxation and political economy. Professor McKenzie has received the Harry Johnson Prize for the best article in the *Canadian Journal of Economics* (1996, with Herb Emery). He is a two time winner of the Douglas Purvis Memorial Prize for a published work of excellence relating to Canadian public policy (1999, with Ron Kneebone; 2010, with Natalia Sershun). In 2000 he was the recipient of the Faculty of Social Sciences Distinguished Research Award at the University of Calgary. He was the EnCana Scholar at the C.D. Howe Institute, where he delivered the 2001 Benefactors Lecture, and has been a visiting fellow at research institutes in both Germany and Australia. He was the inaugural director in 2004 of the University of Calgary's Institute for Advanced Policy Research. Professor McKenzie has acted as an advisor to governments and institutions at the international, federal and provincial levels. He has been on the Panel of Experts for the International Monetary Fund and the World Bank and has provided analysis and advice on tax policy to several developing countries. He has sat on the Taxation and Finance Committee of the Alberta Economic Development Authority, was a member of the Alberta Business Tax Review Committee in 2000, an expert advisor to the Financial Review Commission in Alberta in 2002, and involved in research for the federal government's Technical Committee on Business Taxation in 1997. In 2007 he was a member of the Alberta Royalty Review Panel. Professor McKenzie has served on the Executive Council of the Canadian Economics Association, and on the editorial boards of the *Canadian Journal of Economics* and the *Canadian Tax Journal* and is past editor and associate editor of *Canadian Public Policy*. He served as Department Head in Economics from 2007-2010, and is currently Director of the Tax and Economic Growth Program in The School of Public Policy.

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